QK192
V375
v.1
pt3
c.2

A FLORA OF CALIFORNIA

BY

WILLIS LINN JEPSON

of the University of California (Department of Botany)

PART III.

(Pages 65 to 192)

GNETACEAE TO CYPERACEAE (Cyperus)

GNETACEAE 65
TYPHACEAE 66
SPARGANIACEAE 67
NAIADACEAE 68
JUNCAGINACEAE 76
ALISMACEAE 78
HYDROCHARITACEAE 81
GRAMINEAE 82
CYPERACEAE (Cyperus) 189

GRAMINEAE

BY

A. S. HITCHCOCK

Agrostologist, Bureau of Plant Industry, United States Department of Agriculture

CUNNINGHAM, CURTISS & WELCH
San Francisco

WM. WESLEY & SON
28 Essex St., Strand
London

1912

STUDENTS' CO-OPERATIVE SOCIETY
University of California
Berkeley, Cal.

A FLORA OF CALIFORNIA

Part 1. PINACEAE TO TAXACEAE (Vol. 1, pp. 33 to 64, figs. 1 to 13). $0.90

Part 2. SALICACEAE TO URTICACEAE (Vol. 1, pp. 337 to 368, figs. 61 to 65). 80

Part 3. GNETACEAE TO CYPERACEAE—Cyperus (Vol. 1, pp. 65 to 192). 1.50

Other parts will follow in due course. Attention is especially called to the fact that the pages belonging to each part are indicated above and on cover; pages other than these should not be inquired for under misapprehension that pages are missing from parts 1, 2 or 3.

Address orders to

CUNNINGHAM, CURTISS & WELCH
Publishers and Booksellers
565 MARKET STREET, SAN FRANCISCO, CALIFORNIA

Copyright, 1912,
by
W. L. JEPSON

STYLE OF CITATION

The style of citation to the literature used in the Gramineae is as follows: The first figure refers to the volume; the second figure separated by a colon refers to the page; the third figure separated by a period refers to the year of publication. Michx. Fl. Bor. Am. 1: 48. 1803 is to be read volume 1, page 48, year 1803. A superior figure to the volume number indicates a numbered part, as 2^3: 128, reads volume 2, part 3, page 128. Sometimes volumes in a series are not numbered but indicated by years; in such cases the year will stand in place of the volume number. In the citation of numbered specimens, the number of the specimen follows immediately the name of the collector and is not preceded by the abbreviation "no.," as *Heller* 8075. The style of citation used in the accounts of the other families in this part is essentially the same.

CUNNINGHAM, CURTISS & WELCH

PUBLISHERS AND BOOKSELLERS

BOOKS BY WILLIS LINN JEPSON

A FLORA OF WESTERN MIDDLE CALIFORNIA. 2nd Edition. 516 pages. $2.50.

THE TREES OF CALIFORNIA. 228 pages. 125 original illustrations. $2.50.

A FLORA OF CALIFORNIA. Royal octavo. Illustrated with many original figures. To be completed in two volumes, of about ten parts each, at a variable price per part. The total cost will not exceed $10.00 per volume to subscribers.

THE SILVA OF CALIFORNIA. Royal quarto. 480 pages. 85 plates, 3 maps, 10 figures. Published by the University of California Press. (The returns from the sale of this book go to the University of California and not to the author.) Half Morroco, price $15.00

LIBRARY
NEW YORK
BOTANICAL
GARDEN

Pitt River; American River to Merced River (near Yosemite Valley) and south to South Fork Kaweah.

Refs.—Torreya californica Torr. N. Y. Jour. Pharm. 3: 49 (1854), type loc. headwaters Feather and Yuba rivers; Jepson, Silva Cal. 167, pl. 53 (1910). *Tumion californicum* Greene, Pitt. 2: 195 (1891); Sargent, Silva N. Am. 10: 59, t. 513 (1896); Sudworth, Trees Pac. Coast, 191 (1908).

GNETACEAE. Gnetum Family.

Woody plants without resin, of very diverse habit. Leaves opposite or ternate. Catkins unisexual, with imbricated bracts. Stamens 1, or several and monadelphous, set within a membranous calyx-like perianth, the perianths sessile in the axils of the bracts. Ovule solitary, surrounded by a very small urn-shaped perianth and produced at apex into an exserted style-like process (micropyle), the whole sessile at the summit of the catkin and subtended by its bracts. Embryo axile in endosperm; cotyledons always 2.—Genera 3, the remarkable Welwitschia of South Africa, Gnetum of the tropics, and Ephedra.

1. EPHEDRA L.

Equisetum-like shrubs with slender long-jointed stems, opposite or fascicled branches and scale-like leaves. Leaves more or less connate, sheathing the stem, at length splitting to the base. Staminate and ovulate catkins on different shrubs. Stamens 2 to 8, united into a column. Ovulate perianth indurated in fruit, perforated only for the passage of the micropyle.—Species 30, desert regions of both eastern and western hemispheres. (Greek ephedra, the name used by Pliny for the horse-tails.)

Scales and bracts in 2's; bracts connate at base; ovulate catkins (and sometimes the staminate) on peduncles ½ to 4 lines long.
- Branches bright or yellowish green, erect and broom-like. . . . . 1. *E. viridis.*
- Branches pale or glaucous, divergent. . . . . 2. *E. nevadensis.*

Scales and bracts in 3's; bracts distinct; ovulate catkins sessile or nearly so; branches clustered, erect.
- Fruiting catkin subglobose, 3 to 4 lines long. . . . . 3. *E. californica.*
- Fruiting catkin slender-ovate, 5 to 6 lines long. . . . . 4. *E. trifurca.*

1. **E. viridis** Cov. Erect green shrub 1½ to 3 feet high, with numerous broom-like muriculate branches; fruiting bracts green, firm, with narrow scarious edge; fruits 1 or usually 2 in a place, with flat faces and strongly convex or carinate backs, 3½ to 4 lines long.

Mountain slopes (5000 to 7000 feet alt.) of the desert ranges about the Mohave Desert, Owens Valley and Death Valley, north to the White Mountains and east through Nevada and Arizona to southwestern Utah. Also Ft. Tejon.

Ref.—Ephedra viridis Cov. Contrib. U. S. Nat. Herb. 4: 220 (1893), type from Coso Mts., Inyo Co., *Coville* 923.

2. **E. nevadensis** Wats. Erect olive-colored shrub ½ to 2 feet high; branches somewhat scabrous, divergent; scales sheathing, at length mostly deciduous; fruiting bracts ovate or round ovate, firm, scarious on edges, 4 to 6 pairs; fruit exserted, 3 or 4 lines long, 3-ridged or trigonous, or, when 2 in a place, with more or less flat faces and strongly convex or carinate backs.

Desert valleys of the Mohave and Colorado deserts (2500 to 4500 feet alt.), north to Coney Lake Valley and northern Nevada (Pyramid Lake, *Lemmon*), south into Mexico and Lower California, and east through southern Nevada to Utah. Also Kern Valley and upper San Joaquin Valley.

Refs.—Ephedra nevadensis Wats. Proc. Am. Acad. 14: 298 (1879), Bot. Cal. 2: 108 (1880). *E. antisyphilitica* Wats. U. S. Expl. 40th Par. 5: 328, pl. 39 (1871), not C. A. Mey.

3. **E. californica** Wats. Stems decumbent or spreading, with numerous

erect branches, 1½ to 3 feet high; fruiting bracts reddish or brownish, submembranous, in 4 or 5 whorls, reniform-orbicular, entire, with a short broad claw; fruit ovate, included, 4-angled, 2½ to 3 lines long.

Mohave and Colorado deserts, north to Cantua Creek (western Fresno Co.), west to San Diego and south into Lower California.

Refs.—EPHEDRA CALIFORNICA Wats. Proc. Am. Acad. 14: 300 (1879), type loc. San Diego, *Dr. Palmer;* Bot. Cal. 2: 109 (1880); Abrams, Bull. N. Y. Bot. Gard. 6: 333 (1910).

4. **E. trifurca** Torr. Erect light- or yellowish-green shrub 1½ to 5 feet high, with spinosely tipped straight branches; scales conspicuously sheathing, 3 to 6 lines long; staminate catkins on a very short pedunele; ovulate catkins nearly sessile, of 8 to 10 whorls of bracts; bracts large, very thin, scarious, round-cordate, clawed, with reddish centres; fruit solitary, slender, 4-sided, 6 lines long.

Mohave River at Daggett acc. to Coville (Bot. Death Valley, 220); Yuma, Arizona, *Parish*, in litt.; east to Colorado and Texas, and south into Mexico.

Refs.—EPHEDRA TRIFURCA Torr. in Emory, Mil. Rec. Ft. Leavenworth to San Diego, 153 (1848), type loc. between the Del Norte and Gila rivers.

E. TORREYANA Wats. Erect whitish or pale shrub 1 to 3 feet high, the branches often somewhat flexuous; scales short, 1 to 2 lines long; catkins nearly sessile; ovulate catkins of 6 to 8 whorls of bracts; bracts yellowish or greenish, very thin, very broad, clawed; fruit solitary or in 3's, oblong-lanceolate, scabrous.—Moapa, southern Nevada, *Kennedy*, and east to Colorado. Credited to California by Nelson (Man. Rocky Mts. 31).

ANGIOSPERMS

Trees, shrubs or herbs. Sexual reproductive organ called a flower, typically consisting of a short axis bearing circles of calyx and corolla parts, stamens and pistils. Calyx or corolla or both often absent, and stamens and pistils often in different flowers. Ovules always enclosed in a sac or ovary.

MONOCOTYLEDONS

Leaves parallel-veined. Stems with the vascular bundles scattered irregularly through them, without central pith or concentric woody layers. Flowers with the parts usually in 3's or 6's, never in 5's. Embryo with one cotyledon.

TYPHACEAE. CAT-TAIL FAMILY.

Marsh or aquatic perennial herbs, the solid cylindric jointless stems from creeping rootstocks and bearing long linear alternate leaves. Flowers monoecious, crowded in dense cylindrical spikes, without perianth. Ovary 1-celled, 1-ovuled, with a slender style and elongated lateral stigma, becoming in fruit a seed-like nutlet. Embryo straight, embedded in copious endosperm.—All continents, 1 genus.

Bibliog.—Graebner, P., Typhaceae (Engler, Pflzr. teil 4, abt. 8,—1906). Morong, T., Typha (Bull. Torr. Club, vol. 15, pp. 1-8,—1888).

1. TYPHA L. CAT-TAIL.

Stems tall, simple, ending above in a long spike, the pistillate portion below, the staminate portion above. Stamens seated directly on the axis, intermixed with long bristle-like hairs. Ovaries minute, pedicellate; pedicels bearing clavate bristles which envelope the very small nutlets in a copious down.—Nine species. (Ancient Greek name of the Cat-tail.)

Staminate and pistillate portions of spikes contiguous, rarely separated; pistillate flowers without bractlets. . . . . 1. *T. latifolia.*

Staminate and pistillate portions of spikes usually separated by a small interval; pistillate flowers with bractlets.....2. *T. angustifolia.*

1. **T. latifolia** L. Common Cat-tail. Stout, 3½ to 6 feet high; leaves very long, flat, sheathing at the base, ¼ to 1 inch broad; spike 7 to 13 inches long; pistillate portion of spike without bractlets; stigma rhombic-lanceolate; pollen-grains in 4's; fruiting spike dark brown or blackish, 10 to 12 lines thick.

Common in marshes and marshy places by creeks: San Francisco Bay region, Great Valley and Sierra Nevada foothills, south to southern California, north to Washington. Throughout north temperate zone.

Refs.—Typha latifolia L. Sp. Pl. 971 (1753); Wats. Bot. Cal. 2: 188 (1880); Jepson, Fl. W. Mid. Cal. 96 (1901).

2. **T. angustifolia** L. Stems slender, 3 to 8 feet high; leaves 3 to 6 lines broad, somewhat convex on the back; pistillate flowers with a hair-like bractlet dilated at apex and a linear stigma; pollen-grains simple; fruiting spikes light or dark brown, 5 to 6 lines thick.

Marshes: Los Angeles, San Bernardino, south into Lower California, and east and northeast through the desert regions. North and South America, Europe, Asia, north Africa.

Refs.—Typha angustifolia L. Sp. Pl. 971 (1753); Wats. Bot. Cal. 2: 189 (1880); Abrams, Fl. Los Ang. 8 (1904). *T. bracteata* Greene, Bull. Cal. Acad. 2: 413 (1887), type from Santa Cruz Island, *Greene*. *T. domingensis* Rohrb.; Brandegee, Zoe, 1: 146 (1890).

SPARGANIACEAE. Bur-reed Family.

Marsh or aquatic plants with terete stems from creeping rootstocks, alternate long-linear 2-ranked leaves and monoecious flowers in globose heads. Ovary 1 to 2-celled. Fruit consisting of obovoid or spindle-shaped nutlets, 1 to 2-seeded.—One genus.

Bibliog.—Graebner, P., Sparganiaceae (Engler, Pflzr. teil 4, abt. 10,—1900). Morong, T., Sparganium (Bull. Torr. Club, vol. 15, pp. 73-81,—1888).

1. SPARGANIUM L. Bur-reed.

Perennials with fibrous roots and horizontal rootstocks. Heads scattered along the upper portion of the simple or sparingly branched stem; lower heads pistillate, with leaf-like bracts; upper heads staminate. Stamens with minute scales interposed, their filaments slender and elongated. Ovaries surrounded by 3 to 6 linear-subulate scales forming a sort of calyx.—North temperate and arctic zones, and New Zealand, 15 species. (Sparganion, the Greek name, diminutive of sparganon, a swaddling-band, on account of the ribbon-like leaves.)

Inflorescence compound; pistillate flowers sessile; nutlets obovoid, with truncate or rounded summit; fruiting heads 10 to 15 lines in diameter.....1. *S. eurycarpum.*

Inflorescence simple; pistillate flowers pedicelled; nutlets spindle-shaped, with tapering summit; fruiting heads 7 to 10 lines in diameter.

Leaves (2½ to 5 lines wide) and bracts conspicuously scarious-margined.....2. *S. simplex.*

Leaves (1½ to 2 lines wide) and bracts not conspicuously scarious-margined.....3. *S. angustifolium.*

1. **S. eurycarpum** Engelm. Erect, rather slender, 3 to 8 feet high, with branching inflorescence; leaves flat and thin, slightly keeled beneath; staminate heads 5 to 13; pistillate heads 2 to 4 on the stem or branch, sessile or more commonly peduncled; fruiting heads ¾ to 1¼ inches in diameter; nutlets sessile, obovoid, several-angled, with a truncate or depressed summit, tipped with the short style, 3 (or nearly 3) lines broad, 4 lines long, including the style.

Los Angeles River, *Braunton* 571, to the San Joaquin Valley and north to British Columbia and east to the Atlantic coast.

Var. **greenei** Graebner. Branches of the inflorescence more erect; achenes rounded at summit.—Region of San Francisco Bay (Olema, Lake Merced) south to Lower California and north to British Columbia.

Refs.—SPARGANIUM EURYCARPUM Engelm. in Gray, Man. 5th ed. 481 (1867). Var. GREENEI Graebner in Engler, Pflzr. 4[ie]: 13 (1900). *S. greenei* Morong, Bull. Torr. Club, 15: 77 (1888), type loc. Olema, *Greene;* Jepson, Fl. W. Mid. Cal. 96 (1901). *S. californicum* Greene, Bull. Cal. Acad. 1[1]: 11 (1884), based on material from Calistoga, Sacramento and West Oakland.

2. **S. simplex** Huds. Stems erect, 1 to 3 feet high, or sometimes floating; leaves 2 to 6 lines broad, slightly carinate; inflorescence usually simple; staminate heads 3 to 5, congested or confluent, but distant from the pistillate; pistillate heads 2 to 6, the lowest pedunculed, some supra-axillary, 8 or 9 lines in diameter in fruit; nutlets narrow, 2 to 2½ lines long, 1 to 1½ lines thick on the lower third, at apex gradually attenuate into the long style, long-pediceled, often 2-celled.

Sierra Nevada: Kaweah Meadows; Silver Lake; Placer Co.; Donner Lake; Goose Lake, Shasta Co.; Modoc Co., *Mrs. M. H. Manning.* North to British Columbia and east to New England and Newfoundland.

Ref.—SPARGANIUM SIMPLEX Huds. Fl. Angl. 2d ed. 401 (1778).

3. **S. angustifolium** Michx. Stems 1 to 4 feet high; leaves exceedingly long and narrow, 1 to 2½ lines broad, floating or erect; inflorescence simple; staminate heads 2 to 6, sometimes blended but distant from the pistillate; pistillate heads sessile in the axils, often a little supra-axillary, rarely pedunculed; nutlets 2½ lines long, brownish, constricted at or above the middle, abruptly contracted at apex into the long style or beak, pediceled.

Lakelets and slow streams: San Bernardino Mts. acc. Parish, north to British Columbia and east to Pennsylvania and Newfoundland.

Refs.—SPARGANIUM ANGUSTIFOLIUM Michx. Fl. Bor. Am. 2: 189 (1803); Graebner in Engler, Pflzr. 4[ie]: 16 (1900). *S. simplex* var. *angustifolium* Engelm. in Gray, Man. 5th ed. 481 (1867); Parish, Erythea, 6: 85 (1898).

NAIADACEAE. PONDWEED FAMILY.

Water plants entirely submerged or with floating leaves. Leaves thread-like or grass-like or some with broad floating blades, commonly sheathing at base or with sheathing stipules. Flowers inconspicuous, naked or with a very small calyx, commonly borne on a short spike or spadix. Ovaries 1 to 4, distinct, free from the calyx if that be present, 1-celled, 1-ovuled, ripening into nutlet-like fruits.—Ten genera, the species of mostly wide distribution.

Bibliog.—Tuckerman, Edw., Potamogeton (Am. J. Sci. 2d ser. vol. 6, pp. 224-30,—1848; vol. 7, pp. 347-60,—1849). Morong, T., Naiadaceae of North America (Mem. Torr. Club, vol. 3, no. 2,—1893). Dudley, Genus Phyllospadix (Wilder Quarter-century Book, pp. 403-420, pls. 1-2,—1893). Fryer, A., Potamogetons of the British Isles (1898). Rendle, A. B., Naiadaceae (Engler, Pflzr. teil 4, abt. 12,—1901). Campbell, D. H., Morphological study of Naias and Zannichellia (Proc. Cal. Acad. 3rd ser. Bot. vol. 1, pp. 1-70, pls. 1-5,—1897). Ascherson & Graebner, Potamogetonaceae (Engler, Pflzr. teil 4, abt. 11,—1907).

Flowers perfect, in spikes or clusters.
  Calyx of 4 distinct sepals.....1. POTAMOGETON.
  Calyx none.....2. RUPPIA.
Flowers unisexual; calyx none.
  Leaves entire.
    Pistils about 4, borne in a cup-shaped involucre; fresh water ponds or streams.....
    3. ZANNICHELLIA.

Pistils many, borne on the side of a linear spadix; maritime.
Flowers monoecious; nutlet ovoid; leaves 2 to 4 lines broad.....4. ZOSTERA.
Flowers dioecious; nutlet sagittate-cordate; leaves ½ to 2 lines broad.....
5. PHYLLOSPADIX.
Leaves with spiny-toothed margins; pistil solitary and naked.....6. NAIAS.

1. POTAMOGETON L. PONDWEED.

Perennial herbs, commonly growing in the still waters of creeks and in fresh or brackish ponds, the stems arising from rootstocks. Leaves alternate, or the uppermost opposite, frequently of two kinds, the floating ones broad, the submerged narrower and often thread-like or linear; stipules present, often sheathing the stem. Flowers in spikes or heads on axillary peduncles and enclosed in the bud by stipular sheaths. Sepals 4, with short claws. Stamens 4, inserted on the base of sepals. Ovaries 4.—About 60 species, in all parts of the earth. (Greek potamos, a river, and geiton, a neighbor, on account of the aquatic habit.)

A. Stipules axillary and free from the leaf.

Plants with both submerged and floating leaves; petioles of floating leaves present, often long, short or none in no. 4.
Submerged leaves linear or thread-like, consisting of petioles only.
Floating leaves elliptical, subcordate at base.....1. *P. natans.*
Floating leaves narrowly oblong, attenuate into the petiole.....2. *P. epihydrus.*
Submerged leaves linear or lanceolate, bearing true blades.
Flowers capitate; peduncles 1 to 3 lines long; floating leaves less than 1 inch long.....
3. *P. dimorphus.*
Flowers spicate; peduncles 2 inches long or more; floating leaves 2 to 4 inches long.
Plants reddish; nutlet with a distinct pit on each side.....4. *P. alpinus.*
Plants green; nutlet not pitted.
Nutlet distinctly 3-keeled; low altitudes.....5. *P. americanus.*
Nutlet indistinctly 3-keeled; high montane.....6. *P. heterophyllus.*
Submerged leaves, or some of them, broader and falcate.....7. *P. amplifolius.*
Plants with the leaves all submerged; petioles short or none.
Leaves with broad blades, ovate, orbicular or lanceolate, never linear.
Stipules greenish; leaves with a short petiole or subsessile.....8. *P. lucens.*
Stipules white, with numerous fibrous nerves.
Leaves clasping, hooded at apex; peduncles often 8 inches long or more.....
9. *P. praelongus.*
Leaves cordate-clasping, not hooded, the lobes at base often touching around the stem.
10. *P. perfoliatus.*
Leaves linear, thread-like, or setaceous.
Without propagating buds or glands.....11. *P. foliosus.*
With both propagating buds and glands.
Leaves capillary; stem slender, not flattened.....12. *P. pusillus.*
Leaves linear, 1 to 2 lines wide; stem much flattened.....13. *P. compressus.*

B. Stipules adnate to the leaf or petiole.

Plants with submerged leaves only.
Leaves capillary.....14. *P. pectinatus.*
Leaves flat, ½ to 1½ lines broad.
Leaves in terminal clusters.....15. *P. latifolius.*
Leaves 2-ranked.....16. *P. robbinsii.*

1. **P. natans** L. BROAD PONDWEED. Stem thick, little if at all branched; floating leaves elliptical, subcordate at base, 1½ to 3 inches long, 1 to 2 inches broad, on petioles longer than the blade; stipules linear-lanceolate, membranaceous, 2 to 4 inches long; submerged leaves consisting of petioles without blades, 2 to 9 inches long or more and 1 line wide, usually perishing early, their tips sometimes reaching the surface of the water and forming miniature blades; spikes dense, 1 or 2 inches long, on longer peduncles; nutlet evidently keeled along the back, 2 lines long.

Montane region at 5000 to 7000 feet alt.: Bear Valley, San Bernardino Mts., *Parish;* Sierra Nevada; Mt. Shasta; northward to British Columbia and east to the Atlantic. Europe, Asia.

Refs.—POTAMOGETON NATANS L. Sp. Pl. 126 (1753); Wats. Bot. Cal. 2: 195 (1880); Morong, Mem. Torr. Club, 3^2: 13, pl. 25 (1893).

2. **P. epihydrus** Raf. Stems slender (½ line broad), compressed, mostly simple, 1 to 2 feet long; floating leaves narrowly oblong, 1¾ to 2 inches long, gradually narrowed into petioles about ½ as long; submerged leaves thin, grass-like, 2 to 3 inches long, 2 to 3 lines wide, the petiole-like base very short; spikes dense, ½ inch long, on peduncles 1¼ to 1½ inches long; nutlet flattish, 3-keeled, the seed impressed on the sides.

Yosemite Valley (*Bolander* 6393), north to British Columbia and east to the Atlantic States.

Refs.—POTAMOGETON EPIHYDRUS Raf. Med. Repos. 2d ser. 5: 354 (1808). *P. nuttallii* C. & S. Linnaea, 2: 226 (1827). *P. claytoni* Tuckerm. Am. Jour. Sci. 1st ser. 45: 38 (1843); Wats. Bot. Cal. 2: 195 (1880).

3. **P. dimorphus** Raf. Stems simple, 1½ feet long; floating leaves in 2 or 3 opposite pairs, oblong, tapering to each end, impressed beneath with 7 to 9 nerves, 3 to 4 lines wide and 7 to 10 lines long, passing rather definitely at base into the somewhat shorter (or sometimes longer) petiole; submerged leaves ¼ to ¾ line wide, 1 or 2 inches long, acute at tip but not setaceous, stipules 1 to 5 lines long, adnate for about ½ their length; flowers in a few-flowered head (or the emersed in a very short spike), the peduncles 1 to 3 lines long, shorter than the submersed spike; nutlet less than 1 line long, keeled on the back, the keel winged and sometimes denticulate; embryo coiled 1⅓ times; pericarp very thin and fleshless, revealing clearly the coiled embryo, the whole suggestive of a snail shell.

Lake Surprise, San Jacinto Mts., alt. 9000 feet, *Hall* 2490; near Visalia acc. Bot. Death Valley; irrigating ditches at Turlock. Missouri to Virginia and Nova Scotia.

Refs.—POTAMOGETON DIMORPHUS Raf. Am. Mo. Mag. 1: 358 (1817). *P. spirillus* Tuckerm. Am. Journ. Sci. 2d ser. 6: 228 (1848); Morong, Mem. Torr. Club, 3^2: 49, pl. 56 (1893).

P. HYBRIDUS Michx. Very similar to P. dimorphus but peduncles equaling or longer than submersed spike, frequently recurved; keels toothed.—Credited to California by Taylor (N. Am. Fl. 17^1: 17).

4. **P. alpinus** Balbis. ALPINE PONDWEED. Whole plant of a reddish tinge; stems simple, 1 or 2 feet long; floating leaves narrowly oblong, tapering at both ends, 2 to 4 inches long, ⅓ to ¾ inch wide, submerged leaves 2 to 7 inches long, ¼ to ½ inch wide, all sessile or narrowed to a short petiole; stipules broad, ½ to 1¼ inches long; spikes ⅜ to 1⅛ inches long, on peduncles about 2 inches long; nutlet with a distinct pit on each side.

Ponds in the high mountains: Sierra Nevada, North Fork of Kings River, 7000 feet alt., *Hall & Chandler;* Silver Valley, Alpine Co., 7200 feet alt., *Brewer* 1978; north to Alaska and east to Florida and Labrador. Europe, Asia.

Refs.—POTAMOGETON ALPINUS Balbis, Misc. 13 (1804); Morong, Mem. Torr. Club, 3^2: 19, pl. 30 (1893). *P. rufescens* Schrader; Chamisso, Adnot. Fl. Berol. 5 (1815); Wats. Bot. Cal. 2: 195 (1880).

5. **P. americanus** C. & S. Stems terete, much branched, 3 to 6 feet long; floating leaves coriaceous, elliptical, 2 to 4 inches long, ½ to 1½ inches wide, the petiole often longer than the blade, submerged leaves very thin, lanceolate,

4 to 12 inches long, 4 to 6 lines broad, rounded at base, or tapering into a petiole 1 to 4 inches long; stipules 1 to 4 inches long; peduncles 2 to 3 inches long; spikes 1 to 2 inches long, densely fruited; nutlet obliquely obovate, 1½ to 2 lines long, the back 3-keeled, with the middle keel prominent.

Ponds or slow creeks in the valleys or hills at low altitudes: Los Angeles Co.; Bakersfield and Visalia acc. Bot. Death Valley; Santa Cruz; Russian River; north to British Columbia and east to the Atlantic. Europe, Asia, north Africa.

Refs.—POTAMOGETON AMERICANUS C. & S. Linnaea, 2: 226 (1827); Jepson, Fl. W. Mid. Cal. 2d ed. 28 (1911). *P. lonchites* Tuckerm. Am. Jour. Sci. 2d ser. 6: 226 (1848); Morong, Mem. Torr. Club, 3²: 20, pl. 31 (1893). *P. fluitans* of various California authors.

6. **P. heterophyllus** Schreb. Stems slender, compressed, branched, 1 to 2 feet long; floating leaves oval to oblong-elliptical, 1 or 2 inches long, 4 to 9 lines wide; petioles 1 to 4 inches long; stipules 1 inch long or less; submerged leaves linear-lanceolate, narrowed at base, sessile, 1 to 2 inches long, 1 to 3 lines wide; spikes 1 inch long; peduncles 1 to 4 inches long; nutlet roundish, ¾ to 1½ lines long, indistinctly 3-keeled.

Sierra Nevada at high altitudes: Volcano (formerly Whitney) Meadows, acc. Bot. Death Valley; near Mono Pass acc. Bot. Cal. North to Oregon and Washington and east to the Atlantic. Europe, Asia.

Refs.—POTAMOGETON HETEROPHYLLUS Schreb. Spicil. Fl. Lips. 21 (1771); Morong, Mem. Torr. Club, 3²: 23 (1893). *P. gramineus* Wats. Bot. Cal. 2: 196 (1880), not L.

7. **P. amplifolius** Tuckerm. Stems mostly simple, 2 to 4 feet long; floating leaves oblong-ovate or oval, mucronate, ¾ to 1¼ inches broad, 2 to 3 inches long, the petioles of about the same length; submerged leaves with the sides folding together and assuming a falcate shape, the uppermost large, elliptical or ovate, 2½ to 4 inches long, the lower lanceolate and often as much as 8 inches long and 2 inches wide (acc. Morong); spikes ½ to 2 inches long; peduncles thickening upwards, 2 to 3 inches long; nutlet 3-keeled, the middle keel prominent.

Sierra Nevada from Red Lake on the San Joaquin River, *Congdon*, northward to Oregon and British Columbia and eastward to the Atlantic States.

Refs.—POTAMOGETON AMPLIFOLIUS Tuckerm. Am. Jour. Sci. 2d ser. 6: 225 (1848); Wats. Bot. Cal. 2: 196 (1880); Morong, Mem. Torr. Club, 3²: 16, pl. 27 (1893).

P. ANGUSTIFOLIUS B. & P. Similar to P. lucens; upper leaves petioled, lower sessile, all lanceolate or oblanceolate, undulate, crisped, shining; submerged leaves serrulate at apex.—Credited to California by Taylor, N. Am. Fl. 17¹: 18.

8. **P. lucens** L. Stem thick, branching below and bearing masses of very leafy branches at summit; leaves all submerged, thin, elliptical to lanceolate or oblanceolate or the uppermost oval, acute or acuminate, often undulate-serrate, narrowed at base to a short petiole or sessile, 2 to 7 inches long and ¾ to 1¾ inches wide; stipules greenish, 1 to 2 inches long, loose and spreading, sometimes very broad; peduncles 3 to 6 inches long; spikes 2 to 2½ inches long, thick cylindrical; nutlet 1½ lines long, nearly as broad, with 3 distinct ribs on back.

Small lakes and ponds: Penasquitas Creek, San Diego Co., acc. Parish; San Francisco; north to British Columbia and east to Nova Scotia.

Refs.—POTAMOGETON LUCENS L. Sp. Pl. 126 (1753); Wats. Bot. Cal. 2: 196 (1880); Morong, Mem. Torr. Club, 3²: 30, pl. 38 (1893); Parish, Erythea, 6: 85 (1898); Jepson, Fl. W. Mid. Cal. 100 (1901).

9. **P. praelongus** Wulf. Stems whitish, zigzag, 3 to 8 feet long, branching;

leaves all submerged, bright green, oblong-lanceolate, undulate, "cucullate at apex," sessile by a clasping base, 4 to 9 inches long, and ½ to 1 inch wide; stipules white, the uppermost obtuse, many-nerved, usually hugging the stem, ¾ to 1½ inches long; spikes 1 to 2 inches long, borne on peduncles 4 to 10 inches long (or even longer), erect and straight and often numerous; nutlet 2 to 2½ lines long.

Deep water of ponds: Sierra Co. (acc. Bot. Cal.); Oregon to British Columbia and east to New Jersey and Nova Scotia. Europe.

Refs.—POTAMOGETON PRAELONGUS Wulf. Roem. Arch. 3: 331 (1805); Wats. Bot. Cal. 2: 197 (1880); Morong, Mem. Torr. Club, 3²: 32, pl. 39 (1893).

10. **P. perfoliatus** L. var. **richardsonii** Benn. Stems straight, simple or branching; leaves long-lanceolate and acute, wavy, cordate at base and clasping, 1 to 4 inches long; stipules ½ to ¾ inch long, many nerved, often becoming much frayed; spikes 8 to 11 lines long; peduncles 1¼ inches long; nutlet 1¾ lines long.

Sisson (Siskiyou Co.) acc. Crosfield; Oregon to British Columbia; east to New Jersey and Nova Scotia.

Refs.—POTAMOGETON PERFOLIATUS L. var. RICHARDSONII Benn. Jour. Bot. 27: 25 (1889); Morong, Mem. Torr. Club, 3²: 33 (1893).

11 **P. foliosus** Raf. LEAFY PONDWEED. Stem flattened, much branched, 1 to 2½ feet high; leaves rather thickly clothing the stem, 1 to 1½ inches long, ½ to 1 line wide, abruptly acute; stipules white, transparent, 6 to 9 lines long; flowers few in a head on a peduncle 2 to 6 lines long; nutlet nearly 1 line long, 3-keeled on the back, the central keel with narrow rough-edged wing.

North Fork of Kern River acc. Bot. Death Valley; Gilroy; San Francisco; Birds Landing, *Jepson;* Mariposa, *Congdon;* Shasta Co., *Baker;* northward into Oregon and east to the Atlantic States. Var. CALIFORNICUS Morong. Bushy in its habit; stem thick.—Southern California from San Bernardino to San Diego; Oak Knoll, Los Angeles Co., acc. Davidson; eastern Oregon, acc. Howell. Var. NIAGARENSIS Gray. Large-sized; leaves often 3 inches long or more; stipules longer than in the type.—Visalia, acc. Bot. Death Valley. Ontario to New England and south.

Refs.—POTAMOGETON FOLIOSUS Raf. Med. Repos. 2d hex. 5: 354 (1808); Morong, Mem. Torr. Club, 3²: 39, pl. 47 (1893); Jepson, Fl. W. Mid. Cal. 2d ed. 28 (1911). Var. CALIFORNICUS Morong, Bot. Gaz. 10: 254 (1885), type from San Diego, *Cleveland;* Howell, Fl. Nw. Am. 676 (1903). Var. NIAGARENSIS Gray, Man. 2d ed. 435 (1856). *P. pauciflorus* Pursh, Fl. Am. Sept. 121 (1814); Wats. Bot. Cal. 2: 197 (1880); Jepson, Fl. W. Mid. Cal. 100 (1901). *P. niagarensis* Tuckerm. Am. Jour. Sci. 2d ser. 7: 354 (1849); Wats. Bot. Cal. 2: 197 (1880).

12. **P. pusillus** L. SLENDER PONDWEED. Stems filiform, branching, ½ to 1 foot long; leaves narrowly linear, acute, with a crater-like gland on each side of the stem at base of the petiole or rarely glandless, 1 to 3 inches long, ¼ to ¾ line wide, sessile; stipules short, obtuse, becoming setose; peduncles flattened, slender, ½ to 3 inches long; spikes interrupted or capitate; nutlet obliquely elliptical, ¾ to 1 line long, with a groove on each side of the rounded back, or sometimes with 3 distinct keels, beaked by a short style.

Santa Cruz; Palo Alto; San Francisco; Sierra Nevada; Sisson; Oregon to British Columbia and east to the Atlantic States, south into Mexico. Europe, Asia. Var. TENUISSIMUS Mert. & Koch. Leaves setaceous.—Soda Springs, Tuolumne Meadows, acc. Bot. Cal.

Refs.—POTAMOGETON PUSILLUS L. Sp. Pl. 127 (1753); Wats. Bot. Cal. 2: 198 (1880); Morong, Mem. Torr. Club, 3²: 45, pl. 53 (1893); Jepson, Fl. W. Mid. Cal. 100 (1901). Var. TENUISSIMUS Mert. & Koch, Deutschl. Fl. 1: 857 (1823).

13. **P. compressus** L. EEL-GRASS PONDWEED. Stem very much flattened; foliage bright green and shining; leaves fascicled at summit of the branches, with numerous fine nerves, 2 to 6 inches long, 1¼ to 2 lines wide, abruptly acute, mucronate, sessile; stipules scarious, soon perishing; spikes ½ to 1 inch long, on peduncles 1 to 4 inches long; nutlet nearly or quite 2 lines long, 3-keeled on back.

Honey Lake Valley, Lassen Co., *Davy* 3356; Oregon to British Columbia and east to New Jersey and New Brunswick. Europe.

Refs.—POTAMOGETON COMPRESSUS L. Sp. Pl. 127 (1753); Hegi, Ill. Fl. Mittel-Europa, 1: 132, fig. 60 (1906). *P. zosteraefolius* Schum. Enum. Pl. Saell. 1: 50 (1801); Morong, Mem. Torr. Club, 3²: 37, pl. 45 (1893).

14. **P. pectinatus** L. FENNEL PONDWEED. Stems ½ or 2 to 6 or 8 feet long, from a running rootstock, repeatedly forking above, then very leafy and forming broom-like clusters; leaves very slender, setaceous, 1 to 3 inches long exclusive of the sheaths which are ½ to ¾ inch long or on the lower leaves even 2 inches long; scarious margin of the sheaths very narrow; spikes ½ to 1½ inches long, the flowers in distinctly separated whorls; peduncles 1 to 3 or more inches long; nutlet 1½ to 2 lines long, with an obscure ridge on each side of the back.

The most common species throughout the state from sea-level to 7000 feet altitude. Beyond our borders of world-wide distribution. The rootstocks imbedded in the mud of ponds bear tubers about the size of a pea. The deep-diving ducks, such as the Canvas-back and Broad-bill, feed upon these sweet nutritious tubers, pulling loose at the same time more or less of the tender rootstocks and the attached stems which float to the surface and are shared with the surface-feeding species like the Teal and Mallard. It is to this plant that the Canvas-back, while living in the salt-marshes, owes the succulent and nutty flavor of its flesh, making it in the eyes of sportsman and epicure superior to every other kind of Californian wild-fowl.

Refs.—POTAMOGETON PECTINATUS L. Sp. Pl. 127 (1753); Wats. Bot. Cal. 2: 198 (1880); Morong, Mem. Torr. Club, 3²: 51, pl. 58 (1893); Hegi, Ill. Fl. Mittel-Europa, 1: 137, fig. 67 (1906); Jepson, Fl. W. Mid. Cal. 2d ed. 29 (1911).

15. **P. latifolius** Morong. Near the preceding; stems stoutish, white, branching; leaves numerous, fascicled terminally, ½ to 1½ lines broad; adnate portion of stipule ¼ to 1 inch long, broad on the uppermost leaves, scarious-margined, the free portion shorter.

Brackish water: Honey Lake Valley, Lassen Co., *Davy* 3357; Goose Lake, *Mrs. R. M. Austin*, acc. Morong; also apparently at Gilroy. Northwestern Nevada.

Refs.—POTAMOGETON LATIFOLIUS Morong, Mem. Torr. Club, 3²: 52, pl. 59 (1893); Jepson, Fl. W. Mid. Cal. 2d ed. 29 (1911). *P. pectinatus* var. (?) *latifolius* Robbins, U. S. Expl. 40th Par. 5: 338 (1871), type loc. Humboldt River below Humboldt Lake, Nev.; Wats. Bot. Cal. 2: 198 (1880).

16. **P. robbinsii** Oakes. Stems stout; rootstocks running, sometimes nearly 1 foot long; leaves crowded in 2 ranks, 1½ to 4 inches long, 1½ to 2 lines wide, obtuse, mucronate, auriculate at junction of free portion of stipule; adnate portion of stipules about ½ inch long, the free portion as long or longer.

Honey Lake Valley, Lassen Co., *Davy*. Oregon to British Columbia, east to Delaware and New Brunswick.

Refs.—POTAMOGETON ROBBINSII Oakes, in Hovey, Mag. Hort. 7: 180 (1841); Morong, Mem. Torr. Club, 3²: 54, pl. 61 (1893).

2. **RUPPIA** L.

Immersed aquatic herbs with long filiform forking stems. Leaves almost capillary, with a broad membranous sheathing base. Peduncles slender, axillary, at first very short and enclosed in the spathe-like base of the leaf, each bearing two flowers disposed near together and rising to the surface in the period of anthesis, afterwards coiling and drawing the fruits beneath the surface. Flowers perfect, entirely destitute of perianth. Stamens 2, sessile, each anther consisting of 2 large and separate anther-cells. Pistils 4, after flowering becoming stalked and ripening into hard ovoid nutlets; stigmas depressed, sessile.—One species. (H. B. Ruppius, a German botanist of the 18th century.)

1. **R. maritima** L. Ditch-grass. Plants 2 to 3 feet long; leaves 2 to 3 inches long; nutlets ¾ to 1¼ lines long, raised on stipes 1 to 12 lines long; fruiting peduncle 3 to 6 lines long.

Alkaline or brackish waters: southern California northward through the state. Cosmopolitan.

Refs.—Ruppia maritima L. Sp. Pl. 127 (1753); Wats. Bot. Cal. 2: 194 (1880); Jepson, Fl. W. Mid. Cal. 101 (1901).

3. **ZANNICHELLIA** Mich.

Immersed aquatic plants, flowering and fruiting under water, the thread-like stems from a creeping rootstock. Leaves opposite or in whorls. Flowers monoecious, without perianth, sessile, both kinds in the same axil: staminate flowers consisting of an anther on a pedicel-like filament; pistillate flowers 2 to 6 (usually 4) in a cluster and surrounded by a hyaline cup-shaped involucre shorter than the pistils, each flower consisting of a single pistil with a thin peltate stigma on the summit of the short style. Fruit an oblong somewhat flattened, beaked nutlet.—One species. (G. G. Zannichelli, 1662—1729, a botanist of Venice.)

1. **Z. palustris** L. Horned Pondweed. Stems sparingly branched, 1 to 1½ feet long; leaves 1 to 2 inches long, filiform but flat; nutlet slightly incurved, becoming stipitate, 1 to 1½ lines long, often roughened or toothed on the back.

Pools and still waters of streams: Los Angeles, Santa Barbara and northward to San Leandro Creek, *N. L. Gardner,* and the Sacramento Valley. Nearly throughout North America. Cosmopolitan.

Refs.—Zannichellia palustris L. Sp. Pl. 969 (1753); Wats. Bot. Cal. 2: 193 (1880); Morong, Mem. Torr. Club, 3²: 57, pl. 64 (1893); Jepson, Fl. W. Mid. Cal. 101 (1901).

4. **ZOSTERA** L. Grass-wrack.

Submerged maritime herbs with elongated and very narrow grass-like radical leaves and inflorescences raised on peduncle-like stems. Flowers monoecious, borne in 2 rows on the face of a flattened spadix with or without small lateral appendages covering them in the bud and closely invested by a protecting leaf-like spathe until anthesis. Staminate flower of 1 stamen. Pistillate flower of 1 pistil. Nutlet ovoid.—North and south temperate zones, 5 species. (Greek zoster, a girdle or band, on account of the ribbon-like leaves.)

1. **Z. marina** L. Eel-grass. Leaves with long sheathing bases, 3 to 7-nerved, 1 to 4 feet long, 1 to 4 lines broad; spathes jointed at base, ending above in a more or less elongated leaf-like summit; spadix 2 to 4 inches long, 10 to 20-fruited; fruits 1½ lines long, the ribs of the seed showing clearly on the pericarp.

Shoal waters of bays, San Pedro to San Francisco Bay and north to Alaska.

Var. LATIFOLIA Morong. Stem stout, sometimes 8 or 10 feet long; leaves 3 to 6 lines wide; nutlet with a distinct stipe, the pericarp splitting along the face; seed without ribs.—Santa Barbara (type loc.) to Monterey, Bolinas Bay and northward to Puget Sound.

Refs.—ZOSTERA MARINA L. Sp. Pl. 968 (1753); Wats. Bot. Cal. 2: 192 (1880); Morong, Mem. Torr. Club, 3²: 62, pl. 69 (1893); Jepson, Fl. W. Mid. Cal. 101 (1901). *Z. pacifica* and *oregana* Wats. Proc. Am. Acad. 26: 131 (1891). Var. LATIFOLIA Morong, Bull. Torr. Club, 13: 160 (1886). *Z. latifolia* Morong, Mem. Torr. Club, 3²: 63, pl. 71 (1893).

5. **PHYLLOSPADIX** Hook.

Aquatic plants of rocky ocean shores, closely related to Zostera, with elongated narrowly-linear radical leaves from much branched creeping rootstocks. Flowers dioecious, borne in 2 rows on the side of a flattened spadix, with a lateral chartaceous appendage covering each flower in the bud, the whole inflorescence enclosed by a spathe which is produced beyond the spadix as a foliaceous prolongation. Staminate spadices with sessile anthers; pistils or rudiments none. Pistillate spadices with rudimentary anthers alternating with the pistils; pistils simple, with 2 stigmas; ovary sagittate-cordate, i. e., with two downwardly-produced horns at base, which in fruit are strongly developed and bear on the inside deflexed bristles serving to attach the floating nutlets to other plants on the beaches.—Two or 3 species. (Greek phullon, leaf, and spadix, a kind of inflorescence.)

Flowering stems 1 foot long or more, bearing 2 to 5 pistillate spadices.....1. *P. torreyi.*
Flowering stems 2 or 3 inches long, bearing 1 pistillate spadix or rarely 2.....2. *P. scouleri.*

1. **P. torreyi** Wats. Rootstocks brittle; leaves 1½ to 2 feet long, ½ to 1 line broad; pistillate spadices 1 to 1¾ inches long; staminate spadices shorter and with shorter peduncles; nutlet 2½ lines long.

Low tide limits to two fathoms below: San Diego south to Ensenada (Lower California), north to Santa Barbara, Bolinas Bay and Russian River; usually in more quiet waters than the next. The plants have been used for fireproofing and deadening as a filling between the walls of buildings.

Refs.—PHYLLOSPADIX TORREYI Wats. Proc. Am. Acad. 14: 303 (1879), type loc. Santa Barbara, *Torrey;* Wats. Bot. Cal. 2: 192 (1880); Morong, Mem. Torr. Club, 3²: 64, pls. 72, 74 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901); Abrams, Fl. Los Ang. 14 (1904).

2. **P. scouleri** Hook. Very similar to the preceding but the leaves rather broader, ¾ to 2 lines wide, and more obviously 3-nerved; nutlet larger.

Santa Barbara, Pacific Grove, Dillon's Beach (*Baker*), Russian River (*Dudley*) and northward to the Columbia River and Vancouver Island. Also on the coast of Hokaido (Japan).

Refs.—PHYLLOSPADIX SCOULERI Hook. Fl. Bor. Am. 2: 171, t. 186 (1839); Wats. Bot. Cal. 2: 192 (1880); Morong, Mem. Torr. Club, 3²: 65, pls. 73, 74 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901).

6. **NAIAS** L. NAIAD.

Slender branching submerged fresh-water plants with linear opposite spiny-toothed leaves, which are seemingly whorled on account of the ones crowded in the axils. Flowers monoecious or dioecious, solitary in the axils. Staminate flower consisting of a single stamen enclosed by two perianth-like envelopes. Pistillate flower naked, consisting of a single ovary bearing a style with 2 to 4 stigmas. Fruit a seed-like nutlet, tipped with the persistent style.—World-wide distribution, 32 species. (Greek Naias, a water-nymph.)

Leaves coarsely toothed, the sheathing base entire or with 1 or 2 teeth on each side; stems and back of the leaves often spiny; flowers dioecious.....1. *N. marina.*

Leaves very minutely serrulate; flowers monoecious; stems unarmed.
Nutlet shining, smooth; sheathing base of leaves with many minute teeth on its upper portion. ..... 2. *N. flexilis.*
Nutlet dull, reticulated; sheathing base of leaves commonly narrow and with few teeth or sometimes entire. ..... 3. *N. guadalupensis.*

1. **N. marina** L. Holly-leaved Naiad. Stems stout, often armed with prickles twice as long as their breadth; leaves linear, ¾ to 1½ inches long, 1 to 1½ lines broad, coarsely saw-toothed, with the teeth spinulose-tipped and the broad sheathing base entire or with 1 or 2 teeth on each side; nutlet 2 to 2½ lines long, reticulated.

Clear Lake to Lower California, east to the Atlantic States. Rare in North America. Europe, Asia, Australia. Var. californica Rendle. Internodes sparingly spinose; leaves very coarsely toothed and with 4 to 6 dorsal spines.—Described from specimens collected by Coulter and Orcutt, therefore evidently southern California.

Refs.—Naias marina L. Sp. Pl. 1015 (1753); Morong, Mem. Torr. Club, 3²: 58, pl. 65 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901). Var. californica Rendle, Trans. Linn. 2d ser. 5: 398, t. 39, fig. 15 (1899). *N. major* Allioni, Fl. Pedem. 2: 221 (1785); Wats. Bot. Cal. 2: 191 (1880).

2. **N flexilis** R. & S. Slender Naiad. Stems slender; leaves narrowly linear, very minutely toothed, mostly acuminate, ½ to 1 inch long, ¼ to ½ line wide; nutlet oblong-ovoid, 1 to 2 lines long, nearly smooth, shining.

Southern California (Soldiers' Home, acc. Davidson) to San Francisco, north to Washington and east to the Atlantic. Europe.

Refs.—Naias flexilis R. & S. Fl. Sedin. 382 (1824); Wats. Bot. Cal. 2: 191 (1880); Morong, Mem. Torr. Club, 3²: 59, pl. 66 (1893); Jepson, Fl. W. Mid. Cal. 102 (1901).

3. **N. guadalupensis** Morong. Stems thread-like, 1 to 2 feet long; leaves 6 to 9 lines long, ½ line wide or something less, abruptly acute; nutlet cylindrical, 1 to 1½ lines long, dull but distinctly marked with numerous rows of squarish reticulations.

Oregon to San Francisco and southeastward to the Atlantic. Tropical America.

Refs.—Naias guadalupensis Morong, Mem. Torr. Club, 3²: 60, pl. 67 (1893). *Caulinia guadalupensis* Spreng. Syst. 1: 20 (1825), type loc. Guadalupe Island.

JUNCAGINACEAE. Arrow-grass Family.

Marsh or sub-aquatic herbs with basal rush-like or grass-like leaves, and small flowers in racemes or spikes, or solitary. Perianth regular, 3 or (in ours) 6-parted, the 3 outer segments (sepals) resembling the 3 inner (petals), or perianth none. Stamens in ours 6 or 1. Ovaries 1, or 3 to 6 and united. Embryo straight.—Temperate zones, 5 genera.

Bibliog.—Buchenau, Fr., Scheuchzeriaceae (Engler, Pflzr. teil 4, abt. 14,—1903). Campbell, D. H., Development of the Flower and Embryo in Lilaea subulata (Ann. Bot. vol. 12, pp. 1-28, pls. 1-3,—1898).

Flowers perfect, in a raceme; perianth 6-parted; stamens 6.
Leaves all basal; flowers greenish, numerous in bractless spike-like racemes..1. Triglochin.
Leaves both basal and cauline; flowers white, few in a loose bracted raceme..... 2. Scheuchzeria.
Flowers polygamous, in a spike, also with some solitary; perianth none; stamen 1..3. Lilaea.

1. TRIGLOCHIN L.

Perennial by means of short rootstocks. Leaves fleshy with membranous sheaths. Flowers small, in a spike-like bractless raceme raised on a scape. Perianth 6-parted, deciduous, the three inner segments inserted higher. Stamens in ours 6; anthers sessile or nearly so. Pistils in ours commonly 6 (rarely

3 to 5), their ovaries united around a central axis, splitting when ripe into 1-seeded carpels, which separate from the base upward, and leave a slender persistent axis. Stigmas as many as the ovaries, plumose. Carpels dehiscing by the ventral suture.—World-wide distribution, 12 species. (Greek tri, three, and glochis, a point, referring to the fruit of the 3-carpeled species.)

1. **T. maritima** L. Common Arrow-grass. Terminal portion of the rootstock covered with the sheaths of old leaves; scapes stout, 1 to 1½ feet long, bearing a raceme 10 to 15 inches long, the whole surpassing the (2 to 3 lines wide) leaves; flowers 1 line long, longer than the pedicels, these in fruit conspicuously decurrent; carpels 3-angled, with the dorsal angles winged, making a broad longitudinally-striate groove on the back, 2½ lines long, the stigmas persistent and recurved.

Marshy shores along the coast and saline places in the interior: San Diego and Los Angeles Co., to San Francisco Bay, Great Valley and Sierra Nevada, north to Alaska, east to New Jersey and Labrador. Europe, Asia.

Var. **debilis** Jones. Slender Arrow-grass. Scapes very slender and racemes looser than in the preceding, 7 to 13 inches high; leaves usually less than 1 line wide; flowers about ½ line long; carpels rather less than 2 lines long; fruiting pedicels less obviously decurrent.—Salt marshes, San Francisco Bay; south to Antelope Valley and San Diego, north to Honey Lake Valley, *Davy*, and east to Nevada and Utah.

Refs.—Triglochin maritima L. Sp. Pl. 339 (1753); Wats. Bot. Cal. 2: 199 (1880). Var. debilis Jones, Proc. Cal. Acad. 2d ser. 5: 722 (1895), type loc. alkaline flats at Johnson, Utah. *Jones. T. concinna* Davy, Erythea, 3: 117 (1895); 6: 4, 7 (1898); type loc. Newark, *Davy*, no. 1116; Jepson, Fl. W. Mid. Cal. 103 (1901).

2. SCHEUCHZERIA L.

Rush-like perennials with creeping rootstocks, erect leafy zig-zag stems, and small flowers in a loose terminal raceme. Leaves grass-like, flat above, semiterete below, tubular at apex, sheathing the stem at base, reduced to bracts above. Flowers white, few in a lax raceme. Perianth 6-parted, persistent, its segments nearly alike, the inner narrower. Stamens 6, inserted on the base of the perianth-segments. Ovaries 3, nearly distinct, 1 to 3-ovuled, bearing flat sessile stigmas, becoming in fruit divergent inflated coriaceous follicles dehiscent along the inside.—North temperate zone, 1 species. (The brothers J. and J. J. Scheuchzer, Swiss botanists, early in 18th century.)

1. **S. palustris** L. Stems solitary or several, 4 to 10 inches high; leaves 4 to 12 inches long; pedicels 3 to 10 lines long, spreading in fruit; perianth-segments membranous, 1-nerved, 1½ lines long; follicles 2 to 4 lines long.

Bogs: Sierra Co. (acc. Bot. Cal.) to Oregon and Alaska, east to Pennsylvania and Labrador. Europe, Asia.

Refs.—Scheuchzeria palustris L. Sp. Pl. 338 (1753); Wats. Bot. Cal. 2: 199 (1880); Morong, Mem. Torr. Club, 3²: 9, pl. 23 (1893); Howell, Fl. Nw. Am. 677 (1903).

3. LILAEA H. & B.

Sub-aquatic annual with fibrous roots and basal cylindrical or rush-like leaves sheathing at base. Flowers in spikes raised on scapes and also with solitary pistillate flowers in the axils of the basal leaves. Spikes unisexual or with perfect flowers in the middle, pistillate below and staminate above, all in the axils of bracts except the pistillate. Staminate flowers consisting of a single stamen. Perfect flowers made up of a stamen and a pistil. Pistillate flowers consisting of a single pistil with short style, those in the axils of the basal leaves with extraordinarily long styles. Fruits coriaceous, flattish, oblong-ovate, winged, longitudinally ribbed, 1-seeded, indehiscent, those in the axils

of the basal leaves less compressed and wingless.—One species. (A. R. Delile, French botanist, 1778—1850, author of a Flora of Egypt.)

1. **L. subulata** H. & B. Leaves 6 to 8 inches long, 1 to 2 lines in diameter, tapering to a point; spikes dense, ½ inch long or less; basal pistillate flowers often with a style 1 to 3 inches long, their fruits larger than those of the spike, 2½ to 3 lines long.

In water or mud of shallow vernal pools in the valleys or foothills: British Columbia to middle California (where it is common), south to southern California and Mexico. South America.

Refs.—LILAEA SUBULATA H. & B. Pl. Aequin. 1: 222, t. 63 (1808); Wats. Bot. Cal. 2: 193 (1880); Engler & Prantl, Nat. Pflzfam. 2^1: 225, fig. 172 (1889); Morong, Mem. Torr. Club, 3^2: 10, pl. 24 (1893); Jepson, Fl. W. Mid. Cal. 104 (1901).

ALISMACEAE. WATER PLANTAIN FAMILY.

Marsh or aquatic herbs with basal leaves, scape-like flower stems and perfect or unisexual flowers. Perianth of 3 outer herbaceous persistent sepals and 3 inner white delicate deciduous petals. Stamens 6 to many or numerous. Ovaries numerous, distinct, 1-celled, 1-ovuled, becoming achenes in fruit. Endosperm none; embryo strongly recurved or folded.—Ten genera, temperate and tropic zones.

Bibliog.—Buchenau, Alismataceae (Engler, Pflzr. teil 4, abt. 15,—1903). Smith, J. G., Revision of the North American Species of Sagittaria and Lophotocarpus (Rep. Mo. Bot. Gard. vol. 6, pp. 27-64, pls. 1-29,—1895); Revision of the Species of Lophotocarpus of the U. S. (l. c. vol. 11, pp. 145-151, pls. 53-58,—1899).

Achenes verticillate in a single whorl; stamens 6.
- Petals entire; style lateral; achenes minutely beaked.....1. ALISMA.
- Petals incised; style apical; achenes long-beaked.....2. DAMASONIUM.

Achenes numerous, crowded on a globose or elevated receptacle; stamens 9 to many.
- Leaves entire; achenes turgid; flowers all perfect.....3. ECHINODORUS.
- Leaves typically sagittate; achenes strongly flattened; flowers not all perfect.
  - Flowers polygamous, the lower perfect, the upper staminate.....4. LOPHOTOCARPUS.
  - Flowers unisexual, the lower pistillate, the upper staminate.....5. SAGITTARIA.

1. ALISMA L.

Erect perennial herbs of shallow water or mud. Inflorescence a panicle of whorled branches each bearing a simple or compound umbel of perfect flowers. Petals small, scarcely exceeding the sepals. Stamens 6, with short filaments. Ovaries distinct, on a disk-like receptacle. Achenes numerous, channeled on the back, crowded in a whorl.—One polymorphic species, with several strongly marked subspecies. (Alisma, the Greek name.)

1. **A. plantago** L. WATER PLANTAIN. Plants 2 to 4 (or 6) feet high; rootstock becoming almost bulbous by the sheathing bases of the petioles; leaf-blades ovate to oblong, abruptly acute, the larger often subcordate at base, 2 to 6 (or 9)inches long, usually on long petioles; whorled branches of flowering stems unequal in length, forming a loose pyramidal panicle; pedicels 1 inch long or less; petals white, 1 line long; achenes very strongly flattened, oblong, 1 line long.

Common along the margins of ponds, rivers, and marshy shores of lakes: Coast Ranges; Great Valley; Sierra Nevada to 5000 feet. Widely distributed, as a polymorphic species, through the north temperate zone and in north Africa and Australia.

Refs.—ALISMA PLANTAGO L. Sp. Pl. 342 (1753); Wats. Bot. Cal. 2: 200 (1880); Jepson, Fl. W. Mid. Cal. 104 (1901). A. brevipes Greene, Pitt. 4: 158 (1900); commonly larger, flower parts larger; petals 2 to 3 lines long, much longer than the sepals.—Type loc. Colorado, credited to California in N. Am. Fl. 17^1: 44.

2. **DAMASONIUM** Juss.

Annual or perennial herbs. Flowers perfect. Petals delicate, spreading, incised, soon marcescent. Stamens 6, in pairs opposite each sepal. Ovaries 6 to 10, 1 to several-ovuled, attached by their short ventral side to the conical receptacle. Achenes with long erect beak, radiately whorled and divergent.—Species 4, 3 in Europe, Asia, Africa and Australia, and 1 in California. (Name of uncertain origin.)

1. **D. californicum** Torr. Stems erect, slender, 8 to 16 inches high, arising from tuberous perennial rootstocks; leaf-blades ovate to lanceolate, 3 to 5-nerved, 1 to 1½ inches long, long-petioled; panicle simple, with 2 to 4 verticils of 3 to 10 flowers; petals almost orbicular, 4 to 5 lines long, larger than the sepals; ovaries 1-ovuled; achenes ribbed on back, with long subulate beak.

Pools and shallow shores: Petaluma, *Congdon;* Sacramento Valley (College City, *Emma Wilkins*, Sutter Co., *Copeland*); northern Sierra Nevada from Ione Valley, 500 feet alt., *Bigelow,* to Sierra Valley, *Lemmon,* Big Meadows, Plumas Co., *Mrs. R. M. Austin,* Honey Lake Valley, alt. 4000 feet, *Davy,* and north to Egg Lake, Modoc Co., *Baker.*

Refs.—Damasonium californicum Torr. in Benth. Pl. Hartw. 341 (1857), type from Sacramento Valley (neighborhood of Chico), *Hartweg;* Torr. Pac. R. R. Sur. 4: 142, pl. 21 (1857); Wats. Bot. Cal. 2: 200 (1880). *Alisma californica* Mich. in DC. Monogr. Phan. 3: 34 (1881). *Machaerocarpus californicus* Small. N. Am. Fl. 17¹: 44 (1909).

3. **ECHINODORUS** Rich.

Annual or perennial herbs with the habit of Sagittaria. Stem scapose, with the perfect flowers on short pedicels in umbel-like whorls. Stamens 6 to 12 or more. Ovaries 1-ovuled, many to numerous, crowded on a globose receptacle, attenuate into the terminal style. Achenes sharply ribbed.—Species 18 or 20, North and South America, Europe, Africa. (Greek echinos, hedgehog, and doros, utricle, or leather bottle, in reference to the prickly fruit.)

1. **E. cordifolius** Griseb. Annual; leaf-blades ovate, 5 to 9-nerved, obtuse, truncate or cordate at base, 1½ to 6 (or 8) inches long, long-petioled; scapes erect, 1¼ to 2 feet high; umbels distant, 3 to 12-flowered, proliferous and forming a sparingly branched panicle; corolla 4 to 5 lines broad; stamens 12; fruiting heads globose-ovate, 3 lines long; achenes 1 line long, strongly several-ribbed, with a conspicuous erect straight beak.

Borders of pools and streams, southern California: Garvanza, *Davidson;* Ramona; Elsinore Lake, *Parish;* Lakeside, *Hall.* Eastward to Florida and Illinois and south into Mexico and Lower California. Also lower San Joaquin River, *K. Brandegee,* Sept., 1907.

Refs.—Echinodorus cordifolius Griseb. Abh. K. Ges. Wiss. Gött. 7: 257 (1857). *Alisma cordifolium* L. Sp. Pl. 343 (1753). *Echinodorus rostratus* Engelm. in Gray, Man. 460 (1848); Wats. Bot. Cal. 2: 201 (1880).

4. **LOPHOTOCARPUS** T. Durand.

Closely allied to Sagittaria. Leaves sagittate, sometimes with entire blades or reduced to phyllodes. Flowers polygamous (perfect and staminate). Sepals accrescent, erect and appressed in fruit. Stamens 9 to 21. Fruiting pedicels recurved.—Species 5 or 6, North and South America, Java, Madagascar. (Greek lophos, crest, and karpos, fruit.)

1. **L. calycinus** J. G. Sm. Aquatic; leaves submerged, floating or erect; scapes simple, bearing 3 to 5 whorls of flowers.

Stockton; Los Angeles Co.; east to the Atlantic.

Refs.—Lophotocarpus calycinus J. G. Sm. Rep. Mo. Bot. Gard. 11: 147 (1899). *Sagittaria calycina* Engelm. in Torr. Bot. Mex. Bound. 212 (1859). *Lophotocarpus californicus* J. G. Sm. Rep. Mo. Bot. Gard. 11: 146, pl. 54 (1899), type from Coyote Creek, Los Angeles Co., *Parish Bros.* 1136. *L. fluitans* J. G. Sm. Rep. Mo. Bot. Gard. 11: 145, pl. 53 (1899).

5. **SAGITTARIA** L. Arrow-head.

Marsh or aquatic perennial herbs with thickened or tuberous rootstocks, fibrous roots and milky juice. Leaves sheathing the stem at base; earlier leaves (phyllodia) destitute of blades, later producing small entire blades or most commonly sagittate blades. Flowers pediceled, borne in whorls of 3 on the upper part of the stem, with membranous bracts. Flowers monoecious (rarely dioecious), the staminate above. Petals longer than the sepals. Stamens numerous, inserted above the receptacle. Ovaries indefinitely numerous, crowded on a globose receptacle. Achenes flat, winged or margined, beaked by the short style.—Species about 25, mostly North and South America, a few in Europe and Asia. (Latin sagitta, an arrow, referring to the shape of the leaves.)

Sepals of pistillate flowers reflexed or spreading, not accrescent.
- Pedicels of pistillate flowers slender, ascending; leaves (or some of them) with sagittate lobes.
  - Basal lobes equaling or shorter than the terminal one; achenes without wings or crests on sides.
    - Achenes with prominent horizontally oblique beak ..... 1. *S. latifolia.*
    - Achenes with minute erect beak ..... 2. *S. arifolia.*
  - Basal lobes longer than terminal one; achenes almost beakless, the sides with a prominent wing-margined depression ..... 3. *S. greggii.*
- Pedicels of pistillate flowers much thickened, reflexed in fruit; leaves not sagittate ..... 4. *S. sanfordii.*

Sepals of the pistillate flowers erect and accrescent ..... 5. *S. montevidensis.*

1. **S. latifolia** Willd. Tule Potato. Leaf-blades sagittate, very variable in outline and size, 2 to 12 inches long; basal lobes lanceolate to broadly ovate, acuminate, commonly divaricate, ½ to as long as the terminal lobe; scape simple or branched, ¼ to 3 feet high; flowers monoecious or dioecious; stamens 20 to 25; achene 1½ lines long, with somewhat swollen dorsal wing and long horizontally oblique beak.

Rivers and deltas of the Sacramento and San Joaquin valleys, especially abundant on the river islands; swamps and meadows in the Sierra Nevada to 6000 feet. Los Angeles north to British Columbia. Almost throughout North America. The edible tubers are used by the Chinese of the lower Sacramento.

Refs.—Sagittaria latifolia Willd. Sp. Pl. 4: 409 (1806); Jepson, Fl. W. Mid. Cal. 105 (1901); Abrams, Fl. Los Ang. 18 (1904). *S. variabilis* Engelm. in Gray, Man. 461 (1848); Wats. Bot. Cal. 2: 201 (1880).

2. **S. arifolia** Nutt. Very near the preceding; leaf-blades sagittate, 2½ to 7 inches long; terminal lobe ovate to lanceolate or nearly linear; basal lobes narrower than the terminal; scapes as long as the leaves or commonly shorter; flowers monoecious; achenes obovate, 1 to 1½ lines long, winged all around, bearing a minute erect beak.

San Bernardino Mts. through the Sierra Nevada to Lassen Co., north to British Columbia and east to New Mexico and Nova Scotia.

Refs.—Sagittaria arifolia Nutt.; J. G. Sm., Rep. Mo. Bot. Gard. 6: 32, pl. 1 (1894). *S. cuneata* Sheldon, Bull. Torr. Club, 20: 283, pl. 159 (1893).

3. **S. greggii** J. G. Sm. Plants 2 to 4 feet high; leaf-blades 8 to 16 inches long, on long petioles; basal lobes lanceolate, acuminate, widely divergent, longer than the lanceolate or ovate, acuminate terminal one; submersed leaves

with an entire lanceolate blade 1½ or 2 inches long, or the blade wholly obsolete; whorls numerous; pedicels 4 to 12 lines long; petals orbicular with truncatish or broadly subcordate base, 7 to 10 lines broad, broader than long; stamens 22 to 30, the filaments about as long as the anthers, dilated at base; achenes with acute margins, the sides with an ear-shaped depression margined by a narrow wing and with one or two tube-like passages in the spongy pericarp near the ventral angle.

Lower San Joaquin River islands and shores: Lathrop (*K. Brandegee*, Sept. 1907, fls. & fr.) to Stockton.

Refs.—SAGITTARIA GREGGII J. G. Sm. Rep. Mo. Bot. Gard. 6: 43, pl. 12 (1894), type loc. Stockton, *Sanford*, July, 1893; Smith, l. c., says that a plant collected by Dr. J. Gregg at Zamora, Michoacan, Mexico, seems to be the same as the Californian plant.

4. **S. sanfordii** Greene. Leaves 2 to 3 feet long; petioles obtusely triquetrous, ½ to 1½ inches thick at the base; blades linear- to oblong-lanceolate, 4 or 5 inches long, tapering into the spongy petiole, or almost obsolete in submersed plants; scapes stout, 1½ feet high or more; whorls of flowers usually few; sepals ovate, 2 to 3 lines long; achenes 1 line long, winged on both the inner and outer margins, the sides reticulated; beak nearly erect, short, triangular.

Sloughs and pools, lower San Joaquin River. About 100 acres of pure growth occurs just below the San Joaquin Bridge near Banta.

Refs.—SAGITTARIA SANFORDII Greene, Pitt. 2: 158 (1890); J. G. Sm. Rep. Mo. Bot. Gard. 6: 57, pl. 28 (1894); K. Brandegee, Zoe, 4: 103 (1893).

5. **S. montevidensis** C. & S. Stout; leaves sagittate, strongly many-ribbed; flowers 1 to 1¼ inches broad; petals white, with a brownish purple spot at base; fruiting heads of achenes very large, ¾ to 1¼ inches in diameter.

Introduced at Stockton and Penryn.

Refs.—SAGITTARIA MONTEVIDENSIS C. & S. Linnaea, 2: 156 (1827); J. G. Sm. Rep. Mo. Bot. Gard. 6: 57, pl. 29 (1895); Eastwood, Erythea, 7: 150 (1899).

HYDROCHARITACEAE. FROG'S BIT FAMILY.

Aquatic herbs with dioecious or polygamous regular flowers from a spathe. Stamens 3 to 12. Ovary 1 to 3-celled, inferior; stigmas 3 or 6. Fruit maturing under water, many-seeded, indehiscent.—Genera 14, all continents.

1. ELODEA Michx.

Perennial herbs. Leaves opposite or whorled, crowded, sessile, pellucid. Flowers polygamo-dioecious, solitary and sessile, arising from a tubular 2-cleft axillary spathe. Staminate flowers minute, with 6-parted perianth (3 sepals, 3 petals), and 9 short stamens. Pistillate flowers with 3 calyx-lobes and 3 petals, its long calyx-tube at base coherent with the ovary; ovary 1-celled, with 3 parietal placentae; style capillary, coherent with calyx-tube; stigmas 3; stamens 3 (sometimes rudimentary) or 6.—Species about 5, North and South America. (Greek elodes, marshy.)

1. **E. canadensis** Michx. WATER-WEED. Stems slender, elongated, submerged, ¼ to 2 feet long, varying according to depth of the water; leaves lanceolate to ovate or linear, 1 to 3 lines long; staminate flowers breaking off in anthesis, rising to the surface and shedding their pollen around the pistillate ones; pistillate flowers rising to and expanding on the surface by means of the elongated (2 to 10 inches long) calyx-tube.

Rare in California: Mendocino Co., acc. Bot. Cal.; Truckee, *K. Brandegee;* Egg Lake, Modoc Co., *Baker*. Nearly throughout North America.

Refs.—ELODEA CANADENSIS Michx. Fl. Bor. Am. 1: 20 (1803); *Anacharis canadensis* Planchon; Wats. Bot. Cal. 2: 129 (1880).

GRAMINEAE[1].

By A. S. Hitchcock,

Systematic Agrostologist, U. S. Department of Agriculture.

Mostly herbaceous plants, with usually hollow stems (culms) closed at the nodes, and 2-ranked leaves. Leaves consisting of two parts, the sheath and the blade, the sheath enveloping the culm with the margins usually overlapping, the blade with parallel veins, usually narrowly linear; at the junction of the sheath and blade on the inside, a membranaceous or hyaline appendage, the ligule. Inflorescence paniculate or contracted into racemes or spikes, the branches usually bractless. Flowers usually perfect, small, without a distinct perianth, arranged in spikelets consisting of a shortened axis (rachilla) and 2 to many distichous bracts, the lowest pair (the glumes) empty, each succeeding bract (the lemma) including a single flower and, with its back to the rachilla, a 2-nerved bract or prophyllum (the palea), the flower and its lemma and palea being called the floret. At the base of the flower, between it and the lemma, two small hyaline scales (the lodicules), rarely a third lodicule between the flower and the palea. Stamens usually 3, with delicate filaments and 2-celled versatile anthers. Pistil 1, with a 1-celled 1-ovuled ovary, usually 2 styles and usually plumose stigmas. Fruit a caryopsis with starchy endosperm and a small embryo at the base, on the side opposite the hilum. Grain usually inclosed at maturity in the lemma and palea, free or adnate to the palea.

The stems are woody in bamboos (cultivated in California for ornament) and in a few other groups, and are solid in corn, sorghum and some other large grasses. The sheath is sometimes grown together at the margins, as in Melica and Glyceria. The blade in some tropical grasses is broad or even cordate, and there is occasionally a short petiole above the sheath. The flowers may be monoecious as in the cultivated corn, or dioecious, as in Distichlis and Monanthochloë. One or both of the glumes may be wanting, as in Paspalum and Leersia. The lemma may be sterile, that is, it may contain only stamens, or only the palea, or the latter may be reduced or wanting, or the lemma itself may be variously modified or reduced, as in the upper florets of Melica, or Boutelona. The stamens are rarely 1, 2, or 6, and the styles are rarely 1 or 3. The seed is free from the thin pericarp in Sporobolus, Eleusine, Crypsis and Heleochloa.—A large family of about 500 genera distributed throughout the

[1]This article is published with the permission of the Secretary of Agriculture.

Unless otherwise stated the specimens cited are in the National Herbarium. Readers are especially cautioned against being misled by discrepancies in the numbers, as it occasionally happens that a specimen in the National Herbarium under a given number differs from specimens in other herbaria under the same number. Furthermore there are some irregularities in the numbering of certain series of specimens in the National Herbarium. Davy & Blasdale's numbers are often duplicated on specimens credited to Davy. Specimens collected by Heller & Brown were also distributed as collected by Heller. The data for many specimens collected by Davy in Monterey Co. and elsewhere are placed on labels with a printed heading, "Del Norte, Humboldt and Mendocino Counties." This is misleading only when the locality is not given, or is obscure or local, or is not to be found in the atlases. It is to be regretted that collectors have so often omitted the habitat from the labels. The keys to tribes and genera are based upon the groups as represented in California. Jepson's Flora of Western Middle California, second edition, 1911, has not been cited under references except when it differs from the first.—A. S. Hitchcock.

world, in all latitudes and altitudes where are found conditions suitable for plant growth, but least abundant in dense tropical forests.

Bibliog.—Bentham & Hooker, Gen. Pl. 3: 1074. 1883. Hackel in Engler & Prantl, Pflanzenfam. 2^2: 1. 1887 (with several supplements). The True Grasses, Scribner & Southworth, 1890 (a translation of the preceding). Beal, Grasses N. Am. 2 vols. 1896 (systematic portion in second volume). For cultivated grasses see article on Gramineae in Bailey's Cycl. Agric., and articles on individual genera in Bailey's Cycl. Hort.; also Farm Grasses of U. S. by Spillman, and various bulletins of the U. S. Dept. Agr. Div. Agrost., especially Bull. 14, Economic Grasses. The following more recent articles or monographs include references to California: Vasey, Illustr. N. Am. Grasses, Vol. 1, Grasses of the Southwest (U. S. Dept. Agr. Div. Bot. Bull. 12. in 2 pts. 1891); Vol. 2, Grasses of the Pacific Slope (op. cit. Bull. 13, in 2 pts. 1893). U. S. Dept. Agr. Div. Agrost. Bull. 4. 1897, including revision of Hordeum and Agropyron, by Scribner & Smith; Bull. 7, American Grasses I, Bull. 17, American Grasses II, Bull. 20, American Grasses III, the latter being an account of the genera of N. A. grasses (all by Scribner); Bull. 11, 1898, including a revision of Calamagrostis by Kearney; Bull. 18, 1899, a revision of Sitanion by J. G. Smith; Bull. 21, 1900, a revision of Chaetochloa by Scribner & Merrill; Bull. 23, 1900, a revision of Bromus by Shear, U. S. Dept. Agr. Bur. Pl. Ind. Bull. 9, 1902, a revision of Spartina by Merrill; Bull. 33, 1903, a revision of Leptochloa by Hitchcock; Bull. 68, 1905, a revision of Agrostis by Hitchcock. Contr. Nat. Herb. Vol. 3, pp. 1-89. 1892, a Monograph of the Grasses of the United States by Vasey, including the tribes Maydeae to Agrostideae; Vol. 10, pp. 1-48. 1906, a revision of Festuca by Piper; Vol. 11, 1906, a Flora of the State of Washington by Piper; Vol. 14, pp. 343-428. 1912, the Grama Grasses by Griffiths; Vol. 15, 1910, a revision of Panicum by Hitchcock & Chase. Bolander, Genus Melica in California (Proc. Cal. Acad. 4: 89-104. 1870), Genus Stipa in California (op. cit. 168-170. 1872). Scribner, Revision N. A. Melicae (Proc. Acad. Phila. 1885: 40-48. 1885).

Subfamily I. PANICOIDEAE.

Spikelets with 1 perfect flower, or with a second staminate or neutral flower below. Rachilla articulated below the glumes, the more or less dorsally compressed spikelets falling from the pedicels entire, singly, in groups, or together with joints of an articulate rachis.

Spikelets in pairs (or the terminal in 3's) one sessile or nearly so and fertile, the other pediceled; lemmas hyaline ..... Tribe I. Andropogoneae.

Spikelets not in pairs (in certain genera spikelets paired but lemmas firmer than glumes).

Spikelets in groups at each joint of the main axis, falling off entire; outer glumes larger than the florets ..... Tribe II. Zoysieae.

Spikelets not in groups, falling singly; outer or first glume smaller than the floret. Tribe III. Paniceae.

Subfamily II. POACOIDEAE.

Spikelets 1 to many-flowered, the imperfect or rudimentary floret, if any, uppermost (or if below the fertile one, the spikelet strongly laterally compressed); rachilla usually articulated above the glumes, these persistent on the pedicel or rachis after the fall of the florets; spikelets more or less laterally compressed. The spikelets are articulated below the glumes in Alopecurus, Cinna, Polypogon, Notholcus, Sphenopholis, Spartina and Beckmannia, but these genera are distinguished from Subfamily I by the laterally compressed spikelets.

Spikelets more or less pediceled, in open or contracted panicles, these sometimes spike-like but not 1-sided.

Spikelets with 1 perfect flower, with sometimes a pair of sterile or staminate florets below.

Spikelets with 1 perfect terminal flower and a pair of sterile or staminate florets below, these sometimes reduced to minute bristles ..... Tribe IV. Phalarideae.

Spikelets 1-flowered, the rachilla sometimes prolonged behind the palea as a naked or plumose bristle ..... Tribe V. Agrostideae.

Spikelets 2 to several-flowered.

Awn usually present, often twisted, borne on the back of the lemma or between the teeth of the bifid apex (awnless in Sphenopholis and Koeleria); glumes usually longer than the first floret; rachilla prolonged behind the palea of the uppermost floret ..... Tribe VI. Aveneae.

Awn, when present, terminal, usually straight (the apex of the lemma bifid in Bromus, and in certain species of Festuca and Melica); glumes usually shorter than the first floret ..... Tribe VIII. Festuceae.

Spikelets sessile or nearly so, in spikes, 1 to several-flowered.
Spikelets in 1-sided spikes, usually closely imbricated; spikes digitate or racemose..... TRIBE VII. CHLORIDEAE.
Spikelets sessile on opposite sides of a more or less zigzag jointed channeled rachis, forming a terminal spike; leaf-blades bearing at base a more or less well-marked pair of auriculate appendages..... TRIBE IX. HORDEAE.

Tribe I. Andropogoneae. Spikelets in pairs (or the terminal in 3's) on the usually articulate rachis of a spike-like raceme, one sessile and fertile, the other pediceled and perfect, staminate, neuter or reduced to a rudiment. Glumes more or less indurated. Lemmas smaller than the glumes, hyaline, that of the fertile floret usually awned.

Spikelets awnless..... 1. IMPERATA.
Spikelets awned.
Spikelets in pairs, in racemes, these aggregated in a dense inflorescence... 3. ANDROPOGON.
Spikelets in 3's, in an open panicle..... 2. HOLCUS.

Tribe II. Zoysieae. Spikelets in groups, each group falling as a whole from the axis; glumes firmer than the lemma, the first usually larger than the second; spikelets 1 or 2-flowered, perfect or with staminate spikelets intermixed. Only one genus, Pleuraphis (no. 4), in California. To this tribe belongs the Korean lawn grass (Zoysia pungens Willd.), occasionally cultivated for lawns..... 4. PLEURAPHIS.

Tribe III. Paniceae. Spikelets all alike, the first glume when present, shorter than the floret, the first or lower lemma similar to the glumes in texture, enclosing a staminate flower, or only a palea, or entirely empty, the second or upper lemma and palea indurated, enclosing a perfect flower and persisting as a covering to the fruit.

Spikelets not surrounded by bristles.
Fruit cartilaginous-indurated, the margins of the lemma not inrolled; inflorescence of slender, more or less digitate, spike-like racemes; our species annual... 5. DIGITARIA.
Fruit indurated, the margins inrolled; inflorescence paniculate or spike-like, not digitate in our species.
Spikelets plano-convex, imbricated in spike-like racemes..... 6. PASPALUM.
Spikelets not conspicuously plano-convex.
Fertile palea included at tip; fruit not pointed; inflorescence paniculate.. 7. PANICUM.
Fertile palea free at tip; fruit pointed; spikelets in racemes, these in panicles..... 8. ECHINOCHLOA
Spikelets subtended or surrounded by bristles (sterile branchlets)..... 9. SETARIA.

Tribe IV. Phalarideae. Spikelets with 1 terminal perfect floret and a pair of sterile florets below, the group articulated above the glumes and falling entire; sterile florets sometimes staminate, but usually small, or reduced to mere rudiments or pedicels.

Glumes strongly compressed, boat-shaped; sterile lemmas empty, narrow, bristle-form or scale-like, much shorter than the indurated fertile lemma..... 10. PHALARIS.
Glumes not strongly compressed or boat-shaped; sterile lemmas ovate or oblong, longer than the fertile lemma.
Sterile lemmas, empty, dorsally awned; inflorescence spike-like..... 11. ANTHOXANTHUM.
Sterile florets staminate; inflorescence a somewhat open panicle..... 12. HIEROCHLOË.

Tribe V. Agrostideae. Spikelets 1-flowered, the rachilla sometimes prolonged behind the palea as a naked or plumose bristle; glumes usually as long as or longer than the lemma.

Lemma indurated, usually long-awned, a well marked callus at base.
Awn trifid..... 13. ARISTIDA.
Awn simple.
Awn geniculate and twisted, usually more than ½ inch long..... 14. STIPA.
Awn straight or curved, less than ½ inch long..... 15. ORYZOPSIS.
Lemma membranaceous (rather firm in Muhlenbergia), usually more delicate than the glumes.
Inflorescence a flat-topped head, subtended by 2 inflated sheaths..... 17. CRYPSIS.
Inflorescence sometimes capitate but not flat-topped.
Lemma awned or mucronate from the tip..... 16. MUHLENBERGIA.
Lemma awnless or dorsally awned.
Glumes conspicuously compressed-carinate; spikelets in dense spike-like panicles.
Lemma awnless; glumes abruptly aristate..... 18. PHLEUM.
Lemma awned below the middle; glumes not aristate..... 19. ALOPECURUS.

Glumes not conspicuously compressed.
Pericarp loosely enclosing the seed; inflorescence an open panicle..20. SPOROBOLUS.
Pericarp adherent to the seed; inflorescence open or contracted.
Glumes long-awned .....22. POLYPOGON.
Glumes awnless, or short-awned.
Inflorescence a long slender dense spike-like panicle.....21. EPICAMPES.
Inflorescence often contracted but not conspicuously elongated.
Palea 1-nerved, or apparently so.....23. CINNA.
Palea plainly 2-nerved (sometimes nerveless or wanting).
Glumes plumose-ciliate; inflorescence an ovoid head.....28. LAGURUS.
Glumes not plumose.
Glumes saccate at base, much longer than the lemmas..25. GASTRIDIUM.
Glumes not saccate at base.
Rachilla not prolonged behind the palea (except in A. thurberiana); callus hairs short or none (except in A. hallii)....24. AGROSTIS.
Rachilla prolonged behind the palea as a usually hairy bristle.
Lemma awned from the back; callus hairs long.....
26. CALAMAGROSTIS.
Lemma awnless; callus hairs short.....27. AMMOPHILA.

Tribe VI. Aveneae. Spikelets 2 to several-flowered, in open or contracted panicles; rachilla prolonged behind the uppermost floret (except in Aira); glumes usually longer than the first floret; 1 or more of the lemmas awned on the back or from the teeth of the bifid apex (usually awnless in Koeleria and Sphenopholis); callus and usually the rachilla joints hairy.

Rachilla not prolonged; spikelets 2-flowered, perfect.....30. AIRA.
Rachilla prolonged behind the uppermost floret; spikelets 2 to several-flowered.
Articulation below the glumes, the spikelets falling entire or the glumes and lowest florets together.
Glumes much exceeding the 2 florets; spikelet awned.....29. NOTHOLCUS.
Glumes exceeded by the upper floret; spikelet awnless.....33. SPHENOPHOLIS.
Articulation above the glumes.
Awns wanting or but a mucronate tip.....34. KOELERIA.
Awns present.
Awns from between the teeth of the bidentate apex of the lemma, flattened, twisted.
36. DANTHONIA.
Awns dorsal, not flattened.
Lemmas more than ½ inch long.....35. AVENA.
Lemmas less than ½ inch long.
Lemmas keeled; awn from above the middle.....32. TRISETUM.
Lemmas convex; awn from below the middle.....31. DESCHAMPSIA.

Tribe VII. Chlorideae. Spikelets 1 to several-flowered, sessile in 1-sided spikes; spikes digitate or racemose; lemma awnless or awned from between teeth; spikelets usually compressed and closely imbricated (more distant and often slightly pediceled in Leptochloa).

Spikes digitate.
Plants perennial, extensively creeping.....37. CYNODON.
Plants annual, more or less spreading but not creeping.
Perfect florets 2 or more, awnless.....42. ELEUSINE.
Perfect floret 1 (long-awned).....39. CHLORIS.
Spikes racemose.
Spikelets 1-flowered.
Glumes narrow, unequal .....38. SPARTINA.
Glumes broad, boat-shaped, equal.....41. BECKMANNIA.
Spikelets with more than 1 floret.
Lemmas 3-awned; spikelets imbricated, with only 1 perfect floret.....40. BOUTELOUA.
Lemmas 1-awned or awnless; spikelets somewhat distant, with 3 to several perfect florets .....43. LEPTOCHLOA.

Tribe VIII. Festuceae. Spikelets 2 to many-flowered, pedicellate in racemes or in open or contracted panicles (spikes in Orcuttia; solitary in Monanthochloë); glumes usually

shorter than the first lemma; lemmas awnless or with a straight (rarely bent) awn, terminal or from between the teeth of a bidentate apex.

Spikelets of two kinds in the same inflorescence, perfect and sterile; spikelets fasciculate in 1-sided panicles ..... 57. LAMARCKIA.

Spikelets all alike in the same inflorescence.

Plants dioecious; perennials with creeping rhizomes or stolons (a few species of Poa are dioecious).

Spikelets solitary, concealed in the axils of short crowded rigid leaves ..... 44. MONANTHOCHLOË.

Spikelets in exserted panicles ..... 54. DISTICHLIS.

Plants not dioecious.

Rachilla or lemmas provided with long hairs exceeding the glumes in length; tall reeds.

Hairs on lemmas, the rachilla naked ..... 46. ARUNDO.

Hairs on the rachilla only ..... 47. PHRAGMITES.

Rachilla and lemmas naked or the hairs shorter than the glumes.

Spikelets sessile, in short terminal spikes; lemmas 5-toothed; low annual ..... 45. ORCUTTIA.

Spikelets in racemes or in open or contracted panicles.

Lemmas 3-nerved.

Lemmas pilose on the nerves, longer than the glumes; callus densely villous. 48. TRIDENS.

Lemmas sometimes pubescent but not pilose on the nerves; callus not villous.

Glumes equaling or exceeding the spikelet ..... 49. DISSANTHELIUM.

Glumes shorter than the first floret ..... 50. ERAGROSTIS.

Lemmas 5 to many-nerved.

Spikelets nearly sessile in dense 1-sided clusters at the ends of the few panicle branches ..... 56. DACTYLIS.

Spikelets not in dense 1-sided clusters.

Lemmas flabelliform, many-nerved, petal-like ..... 51. ANTHOCHLOA.

Lemmas not flabelliform.

Palea appendaged on the keels; inflorescence a simple raceme ..... 53. PLEUROPOGON.

Palea not appendaged.

Spikelets very broad, much compressed, cordate; lemmas cordate ..... 55. BRIZA.

Spikelets not broad and cordate.

Lemmas keeled, awnless (keeled in some species of Bromus but the bifid tip acuminate or awned) ..... 58. POA.

Lemmas convex or keeled only at summit.

Glumes large, membranaceous or papery, scarious-margined; upper 2 or 3 lemmas empty, convolute around each other. 52. MELICA.

Glumes not scarious-margined; upper lemmas not empty and convolute around each other.

Nerves of lemmas 5 to 9, parallel, prominent ..... 59. GLYCERIA.

Nerves of lemmas not prominent, or not equally so.

Lemmas obtuse, awnless, scarcely nerved ..... 60. PUCCINELLIA.

Lemmas acute or awned, or, if obtuse, awned between the teeth of the bifid apex.

Lemmas entire, acute or awned from the apex (very narrow teeth in F. elmeri etc) ..... 61. FESTUCA.

Lemmas bifid at apex (except B. brizaeformis), the awn if present from between the teeth ..... 62. BROMUS.

Tribe IX. Hordeae. Spikelets 1 to several-flowered (the uppermost floret imperfect), sessile on opposite sides of a flattened or channeled rachis forming a spike; glumes sometimes small or wanting, sometimes placed in pairs in front of the spikelet; auricular appendages borne at the top of the sheath on each side at base of blade.

Spikelets solitary at each joint of the rachis (occasionally double in Agropyron).

Spikelets placed edgewise to the rachis, the lateral ones with a single glume.

Spikelets several-flowered ..... 63. LOLIUM.

Spikelets 1-flowered ..... 64. MONERMA.

Spikelets placed flatwise to the rachis, all with 2 glumes.
Spikelets several-flowered .....67. AGROPYRON.
Spikelets 1-flowered; spikes very slender.
Lemma awnless .....65. LEPTURUS.
Lemma awned .....66. SCRIBNERIA.
Spikelets, at least some of them, in 2's or 3's at each joint of the rachis.
Spikelets 1-flowered, not all alike, in 3's, the lateral pair pediceled.....68. HORDEUM.
Spikelets 2 to 6-flowered, all alike, usually in 2's.
Glumes minute or wanting; spikes loose.....71. HYSTRIX.
Glumes about as large as the lemmas; spikes dense.
Axis of spike continuous, not disarticulating at maturity; glumes broad or narrow but not greatly elongated.....69. ELYMUS.
Axis of spike disarticulating at maturity; glumes usually setaceous and elongated. 70. SITANION.

TRIBE I. ANDROPOGONEAE.

1. **IMPERATA** Cyrillo.

Spikelets 1-flowered, in pairs, all alike, unequally pedicellate, articulated with the pedicels, densely clothed with long silky hairs. Glumes 2, membranaceous, long-villous. Sterile and fertile lemmas membranaceous, glabrous, the latter narrow, its palea broad, truncate, toothed, surrounding the ovary. Erect perennial grasses with densely villous spike-like terminal panicles.—Warm regions of the world, about 5 species. (The Italian naturalist Ferrante Imperate.)

1. **I. hookeri** Rupr. Culms erect from creeping rhizomes, 3 to 5 feet high, glabrous; sheaths glabrous; ligule long-villous; blades elongated, the lower narrowed at the long conduplicate base, 4 to 6 lines wide, acuminate, glabrous, the upper shorter, the uppermost much reduced; panicle dense, 6 to 12 inches long, pale or tawny, or somewhat rose-tinted, soft, silky; spikelets about 1½ lines long, clothed with hairs twice as long.

Desert regions, from southern California to New Mexico and south into Mexico.

Locs.—Tulare Co., *Palmer* 2748 in 1892; Inyo Co., *Coville & Funston* 219, 240; San Bernardino, *Parish Bros.* 1031; Colorado Desert, *Wilder* 1077.

Ref.—IMPERATA HOOKERI Rupr.; Andersson, Öfv. Vet. Akad. Förh. 12: 160. 1855.

EREMOCHLOA LEERSIOIDES Hack. in DC. Monogr. Phan. 6: 264. 1889. *Ischaemum leersioides* Munro, Proc. Am. Acad. 4: 363. 1860; Thurb. in Wats. Bot. Cal. 2: 262. 1880. Thurber states that this was "collected in San Francisco, near a Chinese Warehouse, *Bolander*." It is a native of China and has not since been collected.

2. **HOLCUS** L.

Spikelets in 3's, terminating the branchlets of the panicle, the central spikelet 1-flowered, sessile, perfect, the lateral pedicellate, staminate. Glumes 2, hard and shining. Sterile lemma hyaline. Fertile lemma small and thin, bearing a geniculate awn. Palea minute. Annual or perennial grasses with terminal, open or contracted panicles.—Species 2, natives of the Old World, one, H. Sorghum L. (Andropogon sorghum Brot.; Sorghum vulgare Pers.), being widely cultivated under the name of Sorghum, Cane, Milo Maize, Durra, Kafir etc. (An old Latin name for a grass, probably from the Greek holcos, attractive.)

1. **H. halepensis** L. JOHNSON GRASS. An erect glabrous robust plant, with extensively creeping rhizomes; culms 2 to 4 feet high; blades flat, 3 to 9 lines wide, the midrib prominent, white; panicle 6 to 10 inches long, more or less spreading; fertile spikelets about 2½ lines long, the glumes pubescent, becoming glabrate and shining; staminate spikelets narrow, 2 lines long, on pedicels 1½ lines long, the glumes membranaceous, nerved, glabrous.

Introduced from the Old World. Occasional from Santa Barbara southward along the coast. A valuable forage grass but having a tendency to become a troublesome weed.

Locs.—Santa Barbara, *Chase* 5612; Pasadena, *Grant* 4133; Santa Ana, *Abrams* 1765; Escondido, *Chandler* 5351.

Refs.—HOLCUS HALEPENSIS L. Sp. Pl. 1047. 1753. *Andropogon halepensis* Brot. Fl. Lusit. 1: 89. 1804. *A. sorghum* Brot. var. *halepensis* Hack. in DC. Monogr. Phan. 6: 502. 1889; Davy in Jepson, Fl. W. Mid. Cal. 29. 1901. *Sorghum halepense* Pers. Syn. 1: 101. 1805; Abrams, Fl. Los Ang. 21. 1904.

3. **ANDROPOGON** L.

Spikelets in pairs (or the terminal in 3's) at each joint of the articulate and usually hairy rachis, one sessile, perfect, 1-flowered, the other pedicellate, staminate, neutral, or reduced to a pedicel. Glumes of fertile spikelet 2, the first more or less indurated, flattened on the back, with 2 prominent nerves near the margin, the central less prominent, the second glume as long as the first, keeled. Sterile and fertile lemmas hyaline, the latter awned. Palea minute or wanting. Annual or perennial, usually coarse grasses with terminal and often axillary inflorescence of one to many spikes.—Species numerous, probably about 200, widely distributed in both hemispheres, except the colder regions. (Greek, aner, man, and pogon, beard, referring to the hairy rachis.)

1. **A. barbinodis** Lag. Culms tufted, erect or somewhat spreading at base, 2 to 4 feet high, glabrous except the densely ascending-hispid nodes; sheaths glabrous; blades 1½ to 3 lines wide, flat, scabrous above, the upper much reduced; panicle 2 to 3 inches long, consisting of several appressed or ascending silky-white racemes, somewhat flabellately aggregated near the summit of the culm; glumes of sessile spikelet 2½ lines long, the awn about 10 lines long, geniculate at the middle, tightly twisted below the bend, loosely twisted above.

Dry hills from Santa Barbara to San Diego, east to New Mexico and south into Mexico.

Locs.—Santa Barbara, *Elmer* 3760; Los Angeles, *Grant* 3461; Santa Monica Mts., *Abrams* 3110; Santa Catalina Island, *Trask;* San Diego, *Baker* 3406.

Refs.—ANDROPOGON BARBINODIS Lag. Gen. & Sp. Nov. 3. 1816. *A. saccharoides* [Swartz, misapplied by] Abrams, Fl. Los Ang. 21. 1904.

TRIBE II. ZOYSIEAE.

4. **PLEURAPHIS** Torr.

Spikelets in 3's at each joint of the inarticulate rachis, villous at base, all sessile and falling off together. Central spikelet 1-flowered, perfect; glumes 2, the summit cleft into several awn-like divisions. Lateral spikelets staminate, 1 or 2-flowered. Perennial, wiry or woody grasses with creeping rhizomes and terminal spikes.—Species 3, in the Sonoran region. (Greek pleura, side, and raphis, needle, referring to the awn on the side of the glume in the type species, P. jamesii.)

Culms felty-pubescent ..... 1. *P. rigida.*
Culms glabrous or slightly puberulent ..... 2. *P. jamesii.*

1. **P. rigida** Thurb. Culms numerous, felty-pubescent, glabrate and scabrous above, 1½ to 3 feet high; leaves felty or glabrous, usually woolly around the top of the sheath; blades 1 to 2 inches long, or longer on sterile shoots, 1 to 2 lines wide, more or less involute, acuminate into a rigid coriaceous point; spikelets about 4 lines long; glumes of central spikelet broadened upward from a narrow base, woolly-ciliate, several-awned from the tip, a stronger dorsal awn from about the middle; lemma 3-nerved, enclosing the palea and a rudimentary second floret, the nerves villous on the back, extending into deli-

cate awns between the ciliate lobes of the apex; lateral spikelets similar, narrower, the glumes less awned at the tip, the second floret similar to the first.

Mohave and Colorado deserts, east to Arizona and south into Mexico.

Locs.—Palm Springs, *Parish* 4145; Whitewater, *Parish Bros.* 880; Newberry, *Chase* 5787; Barstow, *Hall & Chandler* 6844; Mountain Spring, *Schoenfeldt* 3082; San Felipe, *Brandegee* 89; San Jacinto Mts., *Hall* 2118.

Refs.—Pleuraphis rigida Thurb. in Wats. Bot. Cal. 2: 293. 1880. *Hilaria rigida* Benth.; Scribn. Bull. Torr. Club 9: 33. 1882.

2. **P. jamesii** Torr. Galleta. Culms glabrous, the nodes villous; sheaths glabrous or slightly scabrous, sparingly villous around the short membranaceous ligule; blades mostly 1 to 2 inches long, 1 to 2 lines wide, rigid, soon involute, the upper reduced; spikelets 3 to 4 lines long, long-villous at base; glumes of central spikelet pubescent, cuneate, 2-lobed, the lobes 2 or 3-awned, the central nerve between, extending from below the middle into an awn somewhat longer than the others, the awns all minutely plumose; lemma erose at apex, glabrous, 3-nerved, the nerves parallel, the central extending into a short awn; glumes of lateral spikelets narrow, pubescent, the first unsymmetrical, 5-nerved, the second nerve on one side extending into a dorsal awn from below the middle, the apex unequally 2-lobed, the sinus extending down about half-way to the point of departure of the awn, the lobes minutely ciliate; second glume 5-nerved, awnless, entire, ciliate, conduplicate around the floret; lemma as in fertile spikelet; stamens 2.

Deserts of Inyo Co.: Argus Mts., *Hall & Chandler* 7086; Coso Mts., *Coville & Funston* 915. Extends east to Wyoming and Texas, and south into Mexico.

Refs.—Pleuraphis jamesii Torr. Ann. Lyc. N. Y. 1: 148. pl. 10. 1824. *Hilaria jamesii* Benth. Jour. Linn. Soc. Bot. 19: 62. 1881.

Tribe III. PANICEAE.

5. **DIGITARIA** Scop.

Spikelets with 1 perfect flower, sessile or short-pediceled, solitary or in 2's or 3's, in 2 rows on 1 side of a continuous narrow or winged rachis, forming slender spike-like racemes, aggregated toward the summit of the culm. Glumes 1 to 3-nerved, the first small, sometimes obsolete. Sterile lemma 5-nerved, membranaceous. Fertile lemma leathery-indurated, papillose-striate, with a flat hyaline margin. Annual or perennial, mostly weedy grasses with subdigitate inflorescence.—Species about 50, mostly natives of the warmer parts of the Old World, several species being introduced weeds in the New World. (Greek digitus. a finger.)

1. **D. sanguinalis** Scop. Crab-grass. Annual, usually much-branched at base; culms 1 to 3 feet long, geniculate-spreading, or creeping and rooting at the nodes. the flower-stalks more or less erect; sheaths more or less papillose-hirsute; blades lax, 3 to 5 inches long, 2 to 5 lines wide, often pilose; racemes 3 to 12, subdigitate, 2 to 5 inches long; rachis with lateral angles winged; spikelets in pairs, 1½ to 1¾ lines long, usually appressed-pubescent between the smooth or scabrous nerves; pedicels angled; first glume minute; second glume about ½ as long as the spikelet.

A native of the Old World, now a common weed in the warmer parts of the western hemisphere. Cultivated soil and waste places, central and southern parts of the state, especially in the interior valleys.

Refs.—Digitaria sanguinalis Scop. Fl. Carn. ed. 2. 1: 52. 1772. *Panicum sanguinale* L. Sp. Pl. 57. 1753; Thurb. in Wats. Bot. Cal. 2: 258. 1880; Davy in Jepson, Fl. W. Mid. Cal. 31. 1901. *Syntherisma sanguinalis* Dulac, Fl. Haut. Pyr. 77. 1867; Abrams, Fl. Los Ang. 23. 1904.

6. **PASPALUM** L.

Spikelets 1-flowered, plano-convex, nearly sessile, placed with the back of the fertile lemma toward the rachis, solitary or in pairs, in 2 rows on 1 side of a continuous narrow or dilated rachis, forming simple spike-like racemes. First glume usually obsolete (often present in our species). Second glume and sterile lemma membranaceous, about as long as the indurated fertile lemma. Perennials, with 1 to several racemes at the summit of the culm and branches.—Species numerous, probably 200, in the warmer parts of both hemispheres. (Paspalos, a Greek name for millet.)

1. **P. distichum** L. Culms erect from a decumbent rooting base, with numerous creeping rhizomes, glabrous, or the nodes pubescent, 1 to 2 feet high; sheaths glabrous or sometimes pubescent; blades flat, glabrous, rarely pubescent, 2 to 4 inches long, the upper shorter; racemes 2, the second 4 to 5 lines below the first, sometimes a third below the second, more or less pilose at base, slender, ascending or appressed, usually 1 to 2 inches long; spikelets elliptical, 1½ lines long; first glume sometimes wanting, sometimes nearly as long as spikelet, glabrous; second glume pubescent; sterile lemma glabrous.

Along the seacoast (Crescent City, *Davy & Blasdale* 5937) and in ditches and wet places in the interior, central and southern portions of the state (Merced, *Hitchcock* 3211; Los Angeles, *Grant* 1196); rarely northward. Common in tropical America and extending north in the Eastern coastal plain as far as Virginia.

Refs.—PASPALUM DISTICHUM L. Syst. Nat. ed. 10. 2: 855. 1759; Thurb. in Wats. Bot. Cal. 2: 257. 1880; Davy in Jepson, Fl. W. Mid. Cal. 30. 1901; Abrams, Fl. Los Ang. 22. 1904. *Panicum polyrhizum* Presl, Rel. Haenk. 1: 296. 1830, the type from "Monte-Rey", Cal., is in the herbarium of the German University at Prague.

7. **PANICUM** L.

Spikelets with 1 perfect flower and a staminate or neutral flower below. Glumes unequal, first often minute, second usually about equaling the sterile lemma, the latter usually enclosing a palea and sometimes a staminate flower. Fertile lemma and palea indurated, the former inrolled at the margins. Annuals or perennials of various habit, with spikelets borne in panicles.—Species numerous, probably 350, in the warmer regions of both hemispheres. (An ancient Latin name for the millet, Setaria italica.)

Plants annual.
- Fruit transversely rugose ..... 1. *P. arizonicum.*
- Fruit smooth.
  - First glume not over ¼ the length of the spikelet, truncate or broadly triangular; sheaths smooth ..... 2. *P. dichotomiflorum.*
  - First glume as much as ½ the length of the spikelet, acute or acuminate; sheaths hispid.
    - Panicle drooping ..... 6. *P. miliaceum.*
    - Panicle erect.
      - Panicle more than ½ the length of the entire plant.
        - Spikelets 1 to 1¼ lines long ..... 3. *P. capillare.*
        - Spikelets 1½ to 1⅞ lines long ..... 4. *P. barbipulvinatum.*
      - Panicle not more than ⅓ the entire height of plant; spikelets 1⅜ to 1⅝ lines long. 5. *P. hirticaule.*

Plants perennial.
- Spikelets 3 to 3½ lines long ..... 7. *P. urvilleanum.*
- Spikelets ¾ to 1⅝ lines long.
  - Spikelets turgid, strongly nerved, sparsely hispid, 1⅝ lines long ... 14. *P. scribnerianum.*
  - Spikelets not turgid or strongly nerved, pubescent, not over 1½ lines long.
    - Spikelets about 1½ lines long ..... 13. *P. shastense.*

Spikelets not over 1 line long.
Sheaths glabrous ..... 8. *P. lindheimeri.*
Sheaths pubescent.
Plants velvety-pubescent ..... 12. *P. thermale.*
Plants more or less pubescent but not velvety.
Vernal blades glabrous above ..... 10. *P. occidentale.*
Vernal blades pubescent above.
Upper surface of blades pilose; autumnal form decumbent-spreading..... 11. *P. pacificum.*
Upper surface of blades appressed-pubescent; autumnal form erect or ascending ..... 9. *P. huachucae.*

A. True Panicum. Annuals or perennials of various habit, but not forming winter rosettes of leaves different in appearance from the culm leaves, nor presenting a distinct vernal and autumnal aspect.

1. **P. arizonicum** Scribn. & Merr. Annual; culms usually branching from the base, glabrous except below the panicle, 8 inches to 2 feet high; nodes sometimes slightly pubescent; sheaths glabrous to strongly papillose-pubescent; blades 2 to 6 inches long, 3 to 6 lines wide, glabrous or papillose-hispid beneath; panicles long-exserted, finely pubescent and copiously papillose-hirsute, 3 to 9 inches long, the branches solitary, ascending, few-flowered; spikelets nearly 2 lines long, obovate-elliptical, abruptly pointed, densely hirsute to glabrous, borne on very short appressed branchlets.

Open ground; Jamacha, San Diego Co., *Canby* (the only California specimen seen) to western Texas and south into southern Mexico.

Ref.—Panicum arizonicum Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 32: 2. 1901.

2. **P. dichotomiflorum** Michx. Annual, usually much-branched from a geniculate base, smooth throughout; culms rather succulent, 2 to 3 feet high; blades 4 to 20 inches long, about ½ inch wide; panicles 4 to 12 inches long, finally spreading; spikelets 1¼ lines long, narrowly oblong-ovate, acute, faintly 7-nerved, the first glume short, truncate, about ¼ the length of the spikelet.

Low ground and cultivated soil; Fresno, *Bioletti* 140, the only California specimen seen. Common in Eastern U. S.

Refs.—Panicum dichotomiflorum Michx. Fl. Bor. Am. 1: 48. 1803. This species has been incorrectly referred by American botanists to P. proliferum Lam. of the Old World.

3. **P. capillare** L. Old-witch Grass. Annual, erect, 1 to 2 feet high; foliage papillose-hispid; blades 4 to 10 inches long, ¼ to ½ inch wide; panicle large and diffuse, often ½ the length of the entire plant, included at the base until maturity, the whole panicle finally breaking away and rolling before the wind; spikelets about 1 line long, elliptic; first glume acute, ½ as long as spikelet, 5 to 7-nerved.

Open ground, cultivated soil, and river banks, a common weed in Eastern U. S. Pinegrove, Amador Co., *Hansen* 599, the only specimen seen from California.

Refs.—Panicum capillare L. Sp. Pl. 58. 1753. The species described under this name in western floras is usually P. barbipulvinatum.

4. **P. barbipulvinatum** Nash. Closely resembling P. capillare of which it is the western representative, but differing in its stouter habit, shorter, less pubescent blades crowded toward the base of the plant, and especially in the larger spikelets, about 1½ lines long.

Open ground and cultivated soil at moderate altitudes throughout the state and extending from British Columbia to Texas.

Refs.—PANICUM BARBIPULVINATUM Nash in Rydb. Mem. N. Y. Bot. Gard. 1: 21. 1900. This species is described under *P. capillare* in: Thurb. in Wats. Bot. Cal. 2: 258. 1880; Davy in Jepson, Fl. W. Mid. Cal. 32. 1901; Abrams, Fl. Los Ang. 24. 1904.

5. **P. hirticaule** Presl. Annual, erect or nearly so, ½ to 2 feet high, more or less papillose-hispid throughout, especially on the sheaths; blades 2 to 6 lines wide, often sparsely hispid toward the often cordate base; panicle 3 to 6 inches long, scarcely ⅓ the height of the entire plant, open, the branches ascending; spikelets about 1½ lines long, acuminate, usually reddish brown.

Sierra Nevada, *Lemmon* in 1875; San Diego Co. (Jamacha, *Canby* in 1894) to Texas and Central America.

Ref.—PANICUM HIRTICAULE Presl, Rel. Haenk. 1: 308. 1830.

6. **P. miliaceum** L. Annual, as much as 3 feet high; culms and leaves more or less papillose-hispid; panicle 4 to 12 inches long, usually nodding, rather compact, the numerous branches ascending, scabrous, spikelet-bearing toward the summit; spikelets about 2½ lines long, ovate, acuminate, strongly many-nerved; first glume ½ the length of the spikelet, acuminate.

A native of the Old World, cultivated in the U. S. under the name of Hog Millet and Broom-corn Millet. Scattered specimens, introduced or escaped from cultivation, are found throughout the U. S.

Locs.—Kenwood, *Smith* in 1898; Sacramento, *Williams* in 1906; Riverside, *Reed* 3112.

Ref.—PANICUM MILIACEUM L. Sp. Pl. 58. 1753.

P. AGROSTOIDES Spreng. Pl. Pugill. 2: 4. 1815; Thurb. in Wats. Bot. Cal. 2: 258. 1880. In the National Herbarium is a specimen of this species collected by the Wilkes Exploring Expedition, "On the Sacramento." This is far out of its range and the species has not since been collected in California.

7. **P. urvilleanum** Kunth. Plants robust, 2 to 3 feet high, perennial from creeping rhizomes; culms solitary or few in a tuft, the nodes densely bearded but usually hidden by the harshly villous sheaths; blades 2 to 3 lines wide, flat, tapering to a long involute-setaceous point; panicle about a foot long, open; spikelets 3 to 3½ lines long, densely silvery or tawny-villous; first glume acuminate, ⅔ to nearly as long as spikelet.

Sandy deserts, southern California and Arizona, appearing again in Chile and Argentina.

Locs.—Barstow, *Chase* 5766; Hesperia, *Abrams* 2164; Palm Springs, *Wilder* 1082; Edom, *Chase* 5519.

Refs.—PANICUM URVILLEANUM Kunth, Rév. Gram. 2: 403. pl. 115. 1830; Thurb. in Wats. Bot. Cal. 2: 259. 1880. Var. *longiglume* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17. (ed. 2.): 49. 1901, type from San Jacinto, *Parish Bros.* 887.

B. SUBGENUS DICHANTHELIUM Hitchc. & Chase. Tufted perennials, producing winter rosettes of leaves different in appearance from the culm leaves; vernal culms slender, simple, bearing small open, comparatively few-flowered, terminal panicles; autumnal culms much-branched, presenting a distinct aspect, because of the numerous reduced branches, leaves and panicles.

8. **P. lindheimeri** Nash. Vernal culms stiffly ascending or spreading, 1 to 2 feet high, glabrous, or the lower portion somewhat pubescent; leaves glabrous except the ciliate margin of the lower part of the blades; ligule a ring of cilia 2 to 2½ lines long; panicle 2 to 3 inches long, open; spikelets ¾ line long, obovate, obtuse, turgid, pubescent; autumnal form stiffly spreading or radiate-prostrate, with tufts of short appressed branches at the nodes; blades reduced, involute-pointed, often conspicuously ciliate at the base.

Open ground, chiefly in the Eastern States from Maine to Texas. Rare in California; Sacramento, *Michener* 142; Three Rivers, *Coville & Funston* 1286.

Refs.—PANICUM LINDHEIMERI Nash, Bull. Torr. Club 24: 196. 1897. *P. funstoni* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 35: 4. 1901, type *Coville & Funston* 1286.

9. **P. huachucae** Ashe. Vernal form usually stiffly upright, more or less harsh-pubescent throughout; culms 1 to 2 feet high, the nodes bearded; ligule of stiff hairs about 2 lines long; panicle 2 to 3 inches long, the axis and usually the branches pilose; spikelets about 7/8 line long, obovate, turgid, pubescent; autumnal form stiffly erect, the reduced branches fascicled, the crowded blades ascending.

Open ground, chiefly in the Mississippi Valley, rare in California. San Bernardino Mts., *Abrams* 2737.

Ref.—PANICUM HUACHUCAE Ashe, Jour. Elisha Mitchell Soc. 15: 51. 1898.

10. **P. occidentale** Scribn. Vernal form yellowish green; culms slender, 6 to 12 inches high, spreading, sparsely pubescent; leaves tending to be clustered toward the base; sheaths sparsely pubescent; ligule ciliate, about 2 lines long; blades glabrous or nearly so above, appressed-pubescent beneath; panicle 2 to 3 inches long, open; spikelets 7/8 line long, pubescent; autumnal form branching from the lower nodes, forming a spreading tussock; leaves and panicles reduced.

Peat bogs and moist sandy soil, San Diego Co. to British Columbia.

Locs.—Crescent City, *Dary* 5971; Mendocino, *Dary* 6092; New York Falls, *Hansen* 1723; Yosemite Valley, *Brewer* 1646; Merced River, *Torrey* 587; San Diego, *Orcutt* 540.

Refs.—PANICUM OCCIDENTALE Scribn. Rep. Mo. Bot. Gard. 10: 48. 1899. *P. pubescens* [Lam. misapplied by] Presl, Rel. Haenk. 1: 306. 1830.

11. **P. pacificum** Hitchc. & Chase. Vernal form light green, more or less papillose-pilose throughout, 1 to 2 feet high; ligule ciliate, about 2 lines long, spikelets 7/8 to 1 line long, obtuse, pubescent; autumnal form prostrate-spreading, repeatedly branching from the upper and middle nodes.

Sandy shores and slopes, and moist crevices in rocks. San Bernardino Mts. to British Columbia. The commonest species of the genus in California. Distinguished from P. occidentale by the more copious pubescence throughout, more leafy culms, and, in the autumnal form, by the branching habit.

Locs.—Requa, *Davy & Blasdale* 5894; Redding, *Heller* 7856; Yosemite Valley, *Bolander* 4840, *Hall & Babcock* 3317, 3362; Pinegrove, Amador Co., *Hansen* 626; Pt. Reyes, *Davy* 6745, 6780; San Bernardino Mts., *Parish Bros.* 1663.

Refs.—PANICUM PACIFICUM Hitchc. & Chase, Contr. Nat. Herb. 15: 229, f. 241. 1910, type from Castle Crag, *Hitchcock* 3070. *P. dichotomum* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 259. 1880; Davy in Jepson, Fl. W. Mid. Cal. 32. 1901. *P. scoparium* [Lam. misapplied by] Abrams, Fl. Los Ang. 24. 1904. Thurber (l. c.) and Davy (l. c.) also included *P. thermale* and probably other allied species under *P. dichotomum*.

12. **P. thermale** Boland. Vernal form grayish green, densely tufted, velvety-villous, 4 to 12 inches high; culms ascending or spreading; nodes bearded; ligule about 1½ lines long; blades densely velvety-villous on both surfaces; spikelets about 1 line long, pubescent; autumnal form widely spreading, repeatedly branching, forming a dense cushion.

Wet saline soil in vicinity of hot springs, Lassen Peak, *Bolander* 2169; Sonoma Co., *Brewer* 861; common around geysers of Yellowstone Park; also occurring in Alberta and Idaho. Distinguished chiefly by the velvety pubescence and spreading habit.

Refs.—PANICUM THERMALE Boland. Proc. Cal. Acad. 2: 181. 1862, type from Sonoma Co., *Bolander* 3941. Included under *P. dichotomum* by Thurber and by Davy (see above under *P. pacificum*).

13. **P. shastense** Scribn. & Merr. Vernal form 1 to 1½ feet high, papillose-pilose throughout; ligule 1 to 1½ lines long, sparse; spikelets 1¼ lines long, papillose-pubescent; autumnal form spreading, with geniculate nodes and elongated arched internodes, rather sparingly branching from the middle nodes.

Meadows, Castle Crag (the only known locality), *Hitchcock* 3072.

Refs.—PANICUM SHASTENSE Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 35: 3. 1901, type from Castle Crag, *Greata* in 1899.

14. **P. scribnerianum** Nash. Vernal form erect, 1 to 2 feet high; sheaths papillose-hispid; ligule about ½ line long; blades 2 to 3 inches long, 3 to 6 lines wide, firm, rounded and ciliate at base, glabrous above, often pubescent beneath; panicles 2 to 3 inches long; spikelets slightly over 1½ lines long, turgid, blunt, sparsely hispid or nearly glabrous, strongly nerved; autumnal form branching from the middle and upper nodes, the branches longer than the internodes, late in the season producing crowded branchlets with ascending, not greatly reduced blades and small, partially included panicles from their upper nodes.

Dry prairies from Maine to Maryland west to the Pacific, common in the Mississippi Valley, rare in California. Castle Crag, *Hitchcock* 3074.

Refs.—PANICUM SCRIBNERIANUM Nash, Bull. Torr. Club 22: 421. 1895. *P. scoparium* [Lam misapplied by] Thurb. in Wats. Bot. Cal. 2: 259. 1880.

8. ECHINOCHLOA Beauv.

Spikelets with 1 perfect flower, nearly sessile in 1-sided spike-like racemes. Glumes unequal, spiny-hispid, mucronate. Sterile lemma similar and awned from the apex, or sometimes mucronate only, inclosing a hyaline palea and sometimes a staminate flower. Fertile lemma and palea chartaceous, acuminate, the margins of the former inrolled except at the summit, the tip of the palea not included. Coarse annuals with compressed sheaths, long leaves and terminal panicles of stout racemes.—Species about 12, in the warm regions of both hemispheres. (Greek echinos, a hedgehog, and chloa, grass.)

Spikelets awned, the texture firm ..... 1. *E. crusgalli.*
Spikelets awnless, mucronate, the texture rather soft ..... 2. *E. colona.*

1. **E. crusgalli** Beauv. BARN-YARD GRASS. Culms stout, rather succulent, branching from the base or erect, usually 2 to 3 feet high, sometimes larger; leaves glabrous; panicle dense, 4 to 10 inches long, consisting of several erect or spreading, or even drooping racemes; spikelets green or purple, long-awned or nearly awnless, about 1½ lines long, exclusive of awns, densely and irregularly crowded in 3 or 4 rows.

Fields and cultivated soil, especially along irrigating ditches. Common throughout the U. S. A native of the Old World, some forms apparently native in America.

Refs.—ECHINOCHLOA CRUSGALLI Beauv. Ess. Agrost. 53. 1812. *Panicum crusgalli* L. Sp. Pl. 56. 1753; Thurb. in Wats. Bot. Cal. 2: 260. 1880; Davy in Jepson, Fl. W. Mid. Cal. 31. 1901; Abrams, Fl. Los Ang. 23. 1904.

2. **E. colona** Link. Culms erect, spreading or prostrate, 1 to 2 feet high; leaves smooth; panicle of 5 to 10 dense racemes, ½ to 1 inch long, rather distant, racemose along the axis; spikelets about 1½ lines long; glumes and sterile lemma pubescent, mucronate-pointed, but not awned.

Introduced from the Old World into the warmer parts of America. Reported from San Diego Co. by Thurber, and from Los Angeles and Santa Ana by Abrams.

Refs.—Echinochloa colona Link, Hort. Berol. 2: 209. 1833. *Panicum colonum* L. Syst. Nat. ed. 10. 2: 870. 1759; Thurb. in Wats. Bot. Cal. 2: 260. 1880; Abrams, Fl. Los Ang. 24. 1904.

9. **SETARIA** Beauv. Foxtail.

Spikelets as in Panicum but subtended by few or many persistent awn-like branches, arising from the rachis below the articulation of the spikelets. Annual introduced weeds, or native perennials, with cylindrical spike-like bristly panicles. (Latin seta, a bristle.)

Perennial; panicle slender.....3. *S. gracilis.*
Annual; panicle stouter.
Bristles tawny, 5 or more below each spikelet.....1. *S. glauca.*
Bristles green or purple, 1 to 3 below each spikelet.....2. *S. viridis.*

1. **S. glauca** Beauv. Annual; culms branching at the base, compressed, erect or ascending, 1 to 2 feet high; blades flat, with a spiral twist; panicle dense, oblong, 1 to 3 inches long; bristles 5 or more, 2 to 4 lines long, tawny-yellow; spikelets 1½ lines long; fruit undulate-rugose.

A native of Europe, commonly introduced into the U. S. A weed in fields and waste places. Rare in California: Riverside, *Wilder* 1043, 1127; Sacramento, acc. Thurber; Fresno, acc. Davy; Los Angeles, acc. Abrams.

Refs.—Setaria glauca Beauv. Ess. Agrost. 51. 1812; Thurb. in Wats. Bot. Cal. 2: 260. 1880. *Panicum glaucum* L. Sp. Pl. 57. 1753. *Chaetochloa glauca* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897; Davy in Jepson, Fl. W. Mid. Cal. 33. 1901; Abrams, Fl. Los Ang. 25. 1904.

2. **S. viridis** Beauv. Annual; culms 1 to 2 feet high; blades flat, not twisted; panicle oblong-ovate, 1 to 2 inches long; bristles 1 to 3, slender, 3 to 6 lines long, green or purple; spikelets 1 line long; fruit faintly wrinkled.

Introduced from Europe; a common weed in the Eastern States, rare in California (Rialto, *Parish* 2112, the only specimen seen).

Refs.—Setaria viridis Beauv. Ess. Agrost. 51. 1812. *Panicum viride* L. Syst. Nat. ed. 10. 2: 870. 1759. *Chaetochloa viridis* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4: 39. 1897.

3. **S. gracilis** H.B.K. Perennial; culms erect, 3 to 4 feet high; blades elongated, narrow, 1 to 2 lines wide, flat or folded; panicle slender, linear, 3 to 4 inches long, about 1½ lines thick; bristles 5 to 8, twice as long as spikelet, pale or tawny; spikelets 1 line long; fruit undulate-rugose.

Fresno, *Griffiths* 4717; Riverside, *Reed* 1186; east to Florida and south into Mexico.

Refs.—Setaria gracilis H. B. K. Nov. Gen. & Sp. 1: 109. 1816. *Chaetochloa gracilis* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Bull. 21: 15. 1900.

S. imberbis Roem. & Schult. (*Chaetochloa imberbis* Scribn.) is reported from Los Angeles, Santa Ana, and San Bernardino by Abrams (Fl. Los Ang. 25. 1904).

Pennisetum villosum R. Br. A perennial with culms 1 to 2 feet high, villous below the panicle, and dense soft feathery terminal spikes, 1 to 3 inches long; spikelets surrounded by an involucre of several slender plumose bristles about an inch long, the cluster falling from the axis entire.—A native of Abyssinia, cultivated for ornament and occasionally escaped from gardens. Santa Barbara Co., *Eastwood* in 1908, *Chase* 5600.

Leersia oryzoides Swartz, Prodr. 21. 1788; Thurb. in Wats. Bot. Cal. 2: 262. 1880. *Phalaris oryzoides* L. Sp. Pl. 55. 1753. *Homalocenchrus oryzoides* Poll. Hist. Pl. Palat. 1: 52. 1776. Cache Creek, Lake Co., *Bolander* (no. 2418 in the Gray Herbarium), "introduced." San Bernardino, *Parish* in 1885, "probably introduced."

Tribe IV. PHALARIDEAE.

10. **PHALARIS** L.

Spikelets with 1 perfect flower, laterally flattened. Glumes equal, boat-shaped, exceeding the florets. Sterile lemmas 2, small and narrow, appearing like hairy scales attached to the fertile floret. Fertile lemma indurated and shining in fruit, enclosing a faintly 2-nerved palea. Annuals or perennials, with flat blades and dense spike-like panicles.—Species about 10, mostly natives of southern Europe. (An ancient Greek name for a grass.)

Spikelets in groups of 7, 1 fertile surrounded by 6 sterile.....1. *P. paradoxa.*
Spikelets single, all alike.
  Plants perennial.
    Rhizomes absent; panicle dense, ovate or oblong.....2. *P. californica.*
    Rhizomes present; panicle spreading during anthesis.....3. *P. arundinacea.*
  Plants annual.
    Glumes broadly winged; panicle ovate or short-oblong.
      Sterile lemma solitary; fertile lemma 1½ lines long.....4. *P. minor.*
      Sterile lemmas in pairs; fertile lemma 2 to 3 lines long.
        Sterile lemma ¼ line long.....5. *P. brachystachys.*
        Sterile lemma ½ as long as fertile.....6. *P. canariensis.*
    Glumes wingless or nearly so; panicles oblong or linear, dense.
      Glumes acuminate; fertile lemma turgid, the acuminate apex smooth....7. *P. lemmoni.*
      Glumes acute; fertile lemma less turgid, villous to the acute apex.
        Panicle 1 to 2 inches long; sterile lemmas ⅓ as long as fertile....8. *P. caroliniana.*
        Panicle 2 to 5 inches long; sterile lemma ½ as long as fertile.....9. *P. angusta.*

1. **P. paradoxa** L. Annual; culms cespitose, more or less spreading at base, 1 to 2 feet high; panicle dense, oblong, narrowed at base, 1 to 2 inches long, often enclosed at base in the uppermost enlarged sheath; spikelets finally falling from the axis in groups of 7, the central fertile, nearly sessile, the others sterile, slender-pediceled; glumes of sterile spikelets narrow, with faint lateral nerves, the keel prominently winged above, the wing extending into a more or less well-marked tooth, the apex of the glume narrowed into an acuminate point or awn, the glumes of the 4 outer sterile spikelets in the lower part of the panicle more or less deformed; glumes of fertile central spikelet lanceolate, 3 to 4 lines long including awn, the lateral nerves prominent, the wing on the keel more tooth-like, the apex of the glume narrowed into an awn about 1 line long; fertile lemma smooth and shining, 1½ lines long, the sterile lemmas obsolete.

Occasional in grain fields; a native of the Old World, introduced on the Pacific Coast: Richmond, *Congdon.*

Var. **praemorsa** Coss. & Dur. Sterile spikelets short-pediceled, the 4 outer much reduced, the apex deformed or variously incurved; fertile spikelet somewhat indurated, several-nerved at base, acuminate, the wing fin-like in appearance.—Introduced from Europe. Apparently the commoner form in California: Princeton, Berkeley Hills, *Davy;* San Diego, *Brandegee.*

Refs.—Phalaris paradoxa L. Sp. Pl. ed. 2. 2: 1665. 1763; Davy in Jepson, Fl. W. Mid. Cal. 35. 1901, the description applies to the variety. Var. praemorsa Coss. & Dur. Expl. Alg. 2: 24. 1854. *P. praemorsa* Lam. Fl. Franç. 3: 566. 1778.

2. **P. californica** H. & A. Perennial; culms erect or somewhat geniculate at base; blades flat, rather lax, 3 to 6 lines wide; panicle ovoid or oblong, 1 to 2 inches long, ¾ to 1 inch thick, often purplish tinged; glumes about 3 to 3½ lines long, narrow, gradually narrowed from below the middle to an acute apex, smooth or slightly scabrous on the keel, the lateral nerves somewhat

nearer the margin than the keel; fertile lemma ovate-lanceolate, about 2 lines long, rather sparsely villous, often exposing the palea, the sterile lemmas about ½ as long.

Ravines and open ground. Coast Ranges from Mendocino Co. to San Luis Obispo Co.

Loes.—Mendocino, *McMurphy* 456; Sherwood, *Hitchcock* 2707; Ft. Bragg, *Davy & Blasdale* 6165; San Rafael, *Blankinship* 58; San Francisco, *Bolander* 1529; Los Gatos, *Heller* 8568; Monterey, *Bolander* 665; Pacific Grove, *Heller* 6677; Nipoma, *Brewer* 418.

Refs.—PHALARIS CALIFORNICA H. & A. Bot. Beech. 161. 1841, type from San Francisco or Monterey. *P. amethystina* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 265. 1880; Davy in Jepson, Fl. W. Mid. Cal. 36. 1901. Dr. Stapf, who has examined the type specimen of *P. californica* at Kew, informs me that it is the species that has been called *Phalaris amethystina* by California botanists, but which he considers distinct from that species, the type of which is from Chile. I have examined the type specimen of *P. amethystina* in the Trinius Herbarium and agree with Dr. Stapf that it does not belong to the same species as our California plant. The glumes are shorter and scabrous. (*P. amethystina* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 1: 56. 1835, the type specimen from Leona Rancagua, Chile, *Bertero*, no. 354.)

3. **P. arundinacea** L. Perennial, with creeping rhizomes; culms erect, 2 to 5 feet high; panicle 3 to 7 inches long, narrow, the branches spreading during anthesis, the lower as much as 2 inches long; glumes narrow, 2 lines long, abruptly narrowed to an acute apex, the keel scabrous, not winged, the lateral nerves about midway between margin and keel; fertile lemma lanceolate, 1½ lines long, shining, sparsely villous; sterile lemmas villous, ½ line long.

Swamps and moist places, occasional in northern and central California; common throughout the northern parts of North America, Europe and Asia. A form with variegated leaves is cultivated under the name of Ribbon-grass. Ager, *Brandegee* 25; Warner Mts., *Griffiths & Hunter* 407; Bouldin Island, *Congdon*.

Refs.—PHALARIS ARUNDINACEA L. Sp. Pl. 55. 1753; Thurb. in Wats. Bot. Cal. 2: 265. 1880; Davy in Jepson, Fl. W. Mid. Cal. 36. 1901.

4. **P. minor** Retz. Annual; culms erect, 1 to 3 feet high; panicle ovate-oblong to oblong, ½ to 2 inches long; glumes oblong, 2 to 3 lines long, strongly winged on the keel as in P. canariensis, the green stripe less conspicuous, the wing scabrous on margin and more or less toothed; fertile lemma ovate, acute, villous but less so than P. canariensis, about 1½ lines long, the sterile lemma solitary, about ½ line long.

Near the coast from Norman (*Davy* 4265) and Vacaville (*Jepson* 4248) to San Bernardino (*Parish* 4759) and San Diego (*Orcutt* 523). A native of the Mediterranean region, naturalized on the Pacific Coast, occasional in the Eastern States.

Refs.—PHALARIS MINOR Retz. Obs. Bot. 3: 8. 1783; Davy in Jepson, Fl. W. Mid. Cal. 34. 1901; Abrams, Fl. Los Ang. 27. 1904.

5. **P. brachystachys** Link. Annual; culms 1 to 2 feet high; panicle ovate, about an inch long; glumes about 3 lines long, similar to those of P. canariensis; fertile lemma 2 to 2½ lines long, densely short-villous; sterile lemmas short, brown, ovate, equal, about ⅓ line long.

A native of the Mediterranean region, introduced rarely in America. Nelson, Butte Co., *Heller* 5446, the only specimen seen from California. Differs from P. canariensis chiefly in the short sterile lemmas.

Ref.—PHALARIS BRACHYSTACHYS Link, Neu. Jour. Bot. (Schrad.) 1[3]: 134. 1806.

6. **P. canariensis** L. CANARY-GRASS. Annual; culms erect, 1 to 3 feet high; panicle ovate to oblong-ovate, ½ to 1½ inches long, pale with green markings;

glumes 3½ to 4 lines long, oblong but widened above, smooth or sparsely villous, the keel prominently winged above, the wing entire or somewhat sinuous, the keel on each side at base of the white wing marked by a green stripe, the lateral nerves approaching the margin; fertile lemma elliptical, acute, densely short-villous, 2½ to 3 lines long; sterile lemmas about ½ as long as fertile.

A native of the Mediterranean region, introduced occasionally in America. Rare in California: Yreka, *Butler* 488; Pasadena, *Grant* 2648.

Refs.—PHALARIS CANARIENSIS L. Sp. Pl. 54. 1753; Thurb. in Wats. Bot. Cal. 2: 264. 1880; Davy in Jepson, Fl. W. Mid. Cal. 34. 1901.

7. **P. lemmoni** Vasey. Annual; culms erect, 1 to 3 feet high; paniele dense, 2 to 4 inches long; glumes about 2½ lines long, narrow, acuminate, the lateral nerves about midway between margin and keel; fertile lemma ovate-lanceolate, acuminate, dark-colored at maturity, villous except the acuminate tip, 1¾ lines long; sterile lemmas less than ⅓ as long.

Central and southern California, mostly near the coast.

Locs.—Nelson, *Heller* 5447; Chinese Camp, *Bioletti* 5; Newark, *Davy* 1093; Oakland, *Bolander* 1530 in part; Saratoga, *Pendleton* 1500; Santa Cruz, *Anderson;* Tulare Lake, *Davy* 3123; Los Angeles, *Grant* 3839; Inglewood, *Abrams* 3234; San Diego, *Baker* 3425; Santa Catalina Island, *Trask*.

Refs.—PHALARIS LEMMONI Vasey, Contr. Nat. Herb. 3: 42. 1892, type from Santa Cruz, *Lemmon* 403; U. S. Dept. Agr. Div. Bot. Bull. 13: pl. 5. 1892; Davy in Jepson, Fl. W. Mid. Cal. 35. 1901; Abrams, Fl. Los Ang. 27. 1904.

8. **P. caroliniana** Walt. Annual; culms erect, 1 to 2 feet high; paniele oblong, 1 to 2 inches long; glumes 2½ to 3 lines long, oblong, rather abruptly narrowed to an acute apex, the keel scabrous and narrowly winged above from below the middle, the lateral nerves about midway between keel and margin; fertile lemma ovate, acute, densely villous, about 2 lines long, the close-appressed sterile lemmas about ⅓ as long.

A native of the Southeastern States. Apparently introduced in California where it is rare: Comptche, *McMurphy* 478; Ojai Valley, *Hubby* 39a, 51; San Clemente, Santa Catalina and San Nicholas islands, *Trask*.

Refs.—PHALARIS CAROLINIANA Walt. Fl. Carol. 74. 1788; Davy in Jepson, Fl. W. Mid. Cal. 34. 1901.

9. **P. angusta** Nees. Annual; 3 to 5 feet high, smooth; blades flat, 3 to 4 lines wide; paniele dense, linear-oblong, 2 to 5 inches long, about 4 lines thick; glumes about 2 lines long, narrow, rounded at apex to a mucronate tip, scabrous on keel, nerves, and more or less on the back, especially near the apex, lateral nerves near the margin; fertile lemma ovate-lanceolate, acute, villous, 1½ lines long; sterile lemmas about ½ as long.

California to Louisiana.

Locs.—Oakland, *Bolander* 1530 *in* part; San Francisco, *Bolander* 2287; Santa Cruz, *Anderson:* Mt. Brewer, *Brewer* 2801; Visalia, *Coville & Funston* 1282; San Luis Obispo, *Lemmon* 4669; San Bernardino, *Parish* 2165, 4729; Fallbrook, *Abrams* 3344.

Refs.—PHALARIS ANGUSTA Nees, Agrost. Bras. 391. 1829. *P. intermedia* Bosc var. *angusta* Chapm. Fl. South. U. S. 568. 1868; Thurb. in Wats. Bot. Cal. 2: 265. 1880.

11. ANTHOXANTHUM L.

Spikelets with 1 perfect flower. Glumes unequal. Sterile lemmas 2, 2-lobed, dorsally awned, longer than the fertile floret and falling with it. Fertile lemma truncate, awnless, enclosing a faintly 1-nerved palea. Aromatic grasses with narrow spike-like panicles.—Species 4, European. (Greek anthos, flower, and xanthos, yellow.)

1. **A. odoratum** L. Perennial; culms slender, erect, 8 inches to 2 feet high;

paniele 1½ to 3 inches long, pointed; spikelets brownish green, 4 to 5 lines long; glumes sparsely pilose; first sterile lemma short-awned below the apex, the second bearing a strong bent, scarcely exserted awn near its base.

A native of northern Europe and Asia. Occasionally cultivated in the U. S. as a meadow grass, escaped or introduced in the cooler and moister regions. Crescent City, *Davy & Blasdale* 5954; Humboldt Bay, *Chandler* 1106.

Refs.—ANTHOXANTHUM ODORATUM L. Sp. Pl. 28. 1753; Thurb. in Wats. Bot. Cal. 2: 266. 1880; Davy in Jepson, Fl. W. Mid. Cal. 36. 1901.

12. **HIEROCHLOË** R. Br.

Spikelets with 1 perfect and 2 staminate flowers. Glumes about as long as spikelet, boat-shaped, shining. Sterile lemmas nearly as long as glumes, boat-shaped, indurated, hairy, often awned, each enclosing a 2-nerved hyaline palea and 3 stamens. Fertile lemma similar but smaller, enclosing a 1-nerved palea and a perfect flower with 2 stamens. Fragrant perennials with flat blades and terminal panicles.—Species about 13, temperate and arctic regions of both hemispheres. (Greek heros, sacred, and chloe, grass.)

1. **H. macrophylla** Thurb. Culms few, erect, 2 to 3 feet high; sheaths scabrous; blades crowded toward base, flat, rather stiffly upright, scabrous above, glaucous beneath, acuminate-pointed, 3 to 7 lines wide; panicle somewhat open, 3 to 5 inches long, the lower branches spreading or drooping, 1 to 2 inches long; glumes 2 lines long.

Redwood belt from Monterey northward into Oregon.

Locs.—Hydesville, *Blankinship* 22; Hubbard Sta., *Davy & Blasdale* 5400; Harris, *Davy & Blasdale* 5361; Duncan's Mills, *Davy* 1637; Marin Co., *Jepson, Davy* 691; San Mateo Co., *Rutter* 306, *Baker* 247; Wrights, *Elmer* 4742; Santa Cruz, *Anderson;* Santa Lucia Mts., *Plaskett* 26.

Refs.—HIEROCHLOË MACROPHYLLA Thurb.; Boland. Trans. Cal. Agr. Soc. 1864-65: 132. 1866, "Redwoods of the Coast Range, especially in Marin County," type *Bolander* 6070; Thurb. in Wats. Bot. Cal. 2: 265. 1880; Davy in Jepson, Fl. W. Mid. Cal. 37. 1901. *Savastana macrophylla* Beal, Grasses N. Am. 2: 187. 1896. *Hierochloë borealis* [Roem. & Schult, misapplied by] Torr. U. S. Rep. Expl. Miss. Pacif. 4: 154. 1857.

TRIBE V. AGROSTIDEAE.

13. **ARISTIDA** L.

Spikelets 1-flowered, in narrow or open panicles. Glumes narrow, acute, acuminate or short-awned. Lemma with a hard obconical pubescent callus, somewhat indurated, convolute, including the thin palea, terminating in a usually trifid awn. Tufted annuals or perennials with narrow blades.—Species about 100, in the warmer regions of the world. (Latin arista, an awn.)

Plants annual.
- Awns about 5 lines long; paniele closely many-flowered ..... 1. *A. bromoides.*
- Awns 1 to 2 inches long; paniele loosely few-flowered ..... 2. *A. oligantha.*

Plants perennial.
- Glumes about equal.
  - Neck of fruit twisted, exserted from glumes ..... 3. *A. palmeri.*
  - Neck of fruit straight, not exserted from glumes.
    - Branches of panicle horizontally spreading ..... 4. *A. divaricata.*
    - Branches of paniele ascending or appressed ..... 5. *A. parishii.*
- Glumes strongly unequal, the first much shorter than the second.
  - Neck of fruit jointed ..... 6. *A. californica.*
  - Neck of fruit not jointed.
    - Fruit scabrous ..... 7. *A. purpurea.*
    - Fruit smooth.
      - Paniele many-flowered, narrow, strict ..... 8. *A. reverchoni.*
      - Paniele few-flowered, loose ..... 9. *A. fendleriana.*

1. **A. bromoides** H.B.K. Annual; culms much-branched at the base, 4 to 12 inches long, erect or often spreading or prostrate; blades 1 to 2 inches long, narrow, usually involute; panicle narrow, rather dense, 2 to 3 inches long, the branches short, fascicled; glumes unequal, smooth except the keel of the first, 1-nerved, the first 2½ to 3 lines long, acutish, the second 3½ to 4 lines long, obtuse or slightly mucronate; lemma 4 to 5 lines long, smooth except upper portion of keel, the callus with a dense tuft of short hairs, the apex scarcely narrowed; awns equal, finally spreading, about 5 lines long, or the lateral sometimes shorter.

Open ground, southern California to New Mexico and south through Mexico.

Loes.—San Luis Obispo, *Jones* 3245; Funeral Mts., *Coville & Funston* 259; The Needles, *Jones* 3788; western edge Colorado Desert, *Wilder* 1080; Colorado River, Riverside Co., *Hall* 5963; Coachella, *Hall* 5797; San Diego, *Brandegee* 832; Santa Catalina Island, *Brandegee*.

Refs.—Aristida bromoides H. B. K. Nov. Gen. & Sp. 1: 122. 1816; Thurb. in Wats. Bot. Cal. 2: 289. 1880. *A. americana* L. var. *bromoides* Scribn. & Merr. U. S. Dept. Agr. Div. Agrost. Circ. 32:5. 1901 (under a misapprehension as to the identity of *A. americana* L., which is *Boutelona americana* (L.) Scribn. and not *A. dispersa* Trin. & Rupr.); Abrams Fl. Los Ang. 28. 1904.

2. **A. oligantha** Michx. Annual; culms erect, branched at base and all the nodes, 1 to 2 feet high, often woolly at the very base; blades a line wide or less, usually involute, as much as 6 inches long, sparingly pilose at base, the prophyllum often conspicuous at base of branches; panicles narrow, loosely few-flowered, bearing a few scattered large appressed short-pedicelled spikelets; glumes about 1 inch long, slightly unequal, long-awned from a bifid apex, the first strongly 7-nerved; lemma a little shorter than the glumes, the gradually narrowed neck scabernlous, the callus rather minutely pubescent; awns about equal, widely spreading, 2 to 3 inches long.

A native of the Southeastern States, probably introduced in California. Chico, *Copeland* 3488; Mokelumne region, Sacramento Valley, *Fowler;* Merced Falls, *Kelsey*.

Ref.—Aristida oligantha Michx. Fl. Bor. Am. 1: 41. 1803.

3. **A. palmeri** Vasey. Perennial; culms cespitose, erect, 1 to 2 feet high; blades involute, 2 to 4 inches long, a pilose ring at base extending around the collar; panicle about ½ the entire length of the culm, loose; branches mostly in pairs, stiffly ascending or spreading, spikelet-bearing toward the extremities; glumes acuminate, nearly equal, about 5 lines long, scabrous on the keel and the first also on the obscure lateral pair of nerves; lemma 5 to 6 lines long, smooth except the densely pubescent callus, gradually narrowed above into a twisted neck; awns unequal, the central spreading, about 4 lines long, the lateral erect, 1 to 2 lines long.

San Diego Co. (Hanson's Mt., *Orcutt*); Arizona and northern Mexico.

Refs.—Aristida palmeri Vasey, Bull. Torr. Club 10: 42. 1883. *A. lemmoni* Scribn. in Britt. & Kearn. Trans. N. Y. Acad. Sci. 14: 23. 1894.

4. **A. divaricata** Humb. & Bonpl. Perennial; culms cespitose, erect, 1 to 2 feet high; blades involute, as much as 6 inches long; panicle usually more than ½ the length of the entire plant; branches distant, mostly in pairs, divaricately spreading, spikelet-bearing toward the ends; glumes nearly equal, 5 to 6 lines long, 1-nerved, short-awned, the first scabrous on the keel; lemma about 5 lines long, scabrous toward the scarcely narrowed apex; awns about equal, 6 to 10 lines long, somewhat spreading.

Southern California to Texas and south on the Mexican plateau.

Locs.—Bakersfield, *Davy* 1895; Los Angeles, *Hasse;* Pasadena, *Jones* 3216; Pedley Sta., *Reed* 1128; San Jacinto, *Hasse;* San Diego, *Orcutt.*

Ref.—ARISTIDA DIVARICATA Humb. & Bonpl.; Willd. Enum. Pl. 1: 99. 1809.

5. **A. parishii** Hitchc. n. sp. Perennial; culms tufted, 1 to 2 feet high, smooth; sheaths smooth, ciliate at the throat; blades ascending, firm, flat or more or less involute, scabrous on the upper surface, smooth below or scabrous toward the tip, ½ to 1 line wide, 6 to 12 inches long; panicle narrow, about 6 inches long, the branches rather stout, ascending or appressed, the lower 1 to 2 inches long; glumes somewhat unequal, short-awned, smooth or scabrous on the keel, 1-nerved or the first 3-nerved, the second a little longer, 6 lines long; lemma a little shorter than the second glume, very scabrous on the upper half, the neck rather stout, not twisted, the awns ascending, the central about 10 lines long, the lateral a little shorter.—(Perennis, caespitosa, 1-2 ped. alta, glabra; vagina ore ciliata; laminae firmae planae vel plus minus involutae, supra scabrae, ½-1 lin. latae, 6-12 poll. longae; panicula angusta, circa 6 poll. longa, ramis ascendentibus; glumae subaequales, breviter aristatae, 1-nerviae vel prima 3-nervia; lemma glumis brevius, parte superiore scaberrimum, aristis ascendentibus, intermedia circa 10 lin. longa, quam ceteris breviore.)

Type in the U. S. National Herbarium, collected by S. B. & W. F. Parish at Agua Caliente, Colorado Desert, Apr., 1882 (no. 1029a). Other specimens referred to this species are: San Diego, *Cleveland;* Cohuila Creek, San Jacinto For. Res., *Leiberg* 3188; Jurupa Hills, *Wilder* 1047½. Differs from A. divaricata chiefly in the shape of the panicle, the branches being short and appressed instead of long and divaricate.

6. **A. californica** Thurb. Perennial; culms cespitose, much-branched at base, 6 inches to 1 foot high; blades short, involute, sharp-pointed, ½ to 1½ inches long; panicles numerous, loose, 1 to 2 inches long, the few branches few-flowered; glumes smooth or the first slightly scabrous near apex, 1-nerved, awnless, unequal, the first 4 lines long, the second about twice as long; lemma 3 lines long, smooth, except the short-pubescent callus, nearly 1 line long, the narrowed apex articulated with the slender, spirally twisted, 9 lines long neck of the awns; awns equal, spreading, about 1 inch long.

Deserts of southern California, Arizona and northern Mexico. The Needles, *Jones* 68a; Borrego Springs, *Brandegee* 106.

Refs.—ARISTIDA CALIFORNICA Thurb.; Boland. Trans. Cal. Agr. Soc. 134. 1864, nomen nudum; Thurb. in Wats. Bot. Cal. 2: 289. 1880, the original specimens cited are: Colorado Desert *(Schott)* and Fort Mohave *(Cooper).* Var. *fugitiva* Vasey, Contr. Nat. Herb. 3: 49. 1892, type from the Colorado Desert, *Orcutt* 1486. *A. jonesii* Vasey, l. c. 48, as a synonym under *A. californica.*

7. **A. purpurea** Nutt. Perennial; culms erect, about 2 feet high; blades flat or involute, 2 to 5 inches long; panicles 4 to 6 inches long, rather loose; branches and pedicels slender, more or less recurved; glumes unequal, smooth, short-awned, 1-nerved, the first 3 lines long, the second about twice as long; lemma about 6 lines long, purple, strongly scabrous in lines, the apex somewhat narrowed, flattened and slightly twisted; awns equal, about 1¼ inches long.

Plains and deserts, southern California to Texas and northern Mexico.

Locs.—San Bernardino, *Parish* 2123, 3668; Mentone, *Leiberg* 3295; Jurupa Hills, *Wilder* 1047; The Needles, *Jones* 64a; Riverside, *Reed* 1129; San Jacinto, *Parish Bros.* 1549; Fallbrook, *Parish* 2242.

Refs.—ARISTIDA PURPUREA Nutt. Trans. Am. Phil. Soc. 5: 145. 1837. *A. aequiramea*

Scheele, Linnaea 22: 343. 1849. *A. filipendula* Buckl. Proc. Acad. Phila. 1862: 93. 1862. *A. purpurea* Nutt. var. *californica* Vasey, Contr. Nat. Herb. 3: 47. 1892, type *Lemmon* 5474, Capay Valley, Yolo Co., but locality out of range and may be an error. *A. fasciculata* Torr. var. *californica* Vasey; Beal, Grasses N. Am. 2: 207. 1896. *A. purpurea* Nutt. var. *acquiramea* Merr. U. S. Dept. Agr. Div. Agrost. Circ. 34: 7. 1901; Abrams, Fl. Los Ang. 29. 1904.

8. **A. reverchoni** Vasey. Perennial; culms densely cespitose, erect, 1 to 2 feet high; blades involute, more or less flexuous, as much as 6 inches long; panicle narrow, 4 to 6 inches long; branches short, appressed; glumes unequal, awnless, smooth, or the first scabrous on the upper part of keel, the first about 3 lines long, the second about 5 lines long; lemma 5 to 6 lines long, smooth except the minutely pubescent callus, narrowed above but not twisted; awns equal, about 10 lines long.

Deserts and plains, southern California (Newberry, *Chase* 5788) to Texas.

Ref.—ARISTIDA REVERCHONI Vasey, Bull. Torr. Club 13: 52. 1886.

9. **A. fendleriana** Steud. Perennial; culms densely cespitose, erect, usually less than 1 foot high, blades crowded at base of culms forming a curly tuft, involute, arcuate, sharp-pointed, pilose at base, usually 1 to 2 inches long, but sometimes longer; panicle narrow, 2 to 4 inches long, bearing a few, mostly short-pediceled, loosely arranged, more or less appressed spikelets; glumes unequal, smooth, awnless, 1-nerved, the first about 3 lines long, the second 5 to 6 lines long; lemma 4 lines long, scaberulous and slightly narrowed above; callus minutely pubescent, ½ line long; awns equal, about 1 inch long, ascending.

Deserts and plains, southern California to Texas. San Bernardino Mts., *Parish* 3299, 3828.

Refs.—ARISTIDA FENDLERIANA Steud. Syn. Pl. Glum. 1: 420. 1854. *A. purpurea* Nutt. var. *fendleriana* Vasey, Contr. Nat. Herb. 3: 46. 1892. *A. fasciculata* Torr. var. *fendleriana* Scribn. in Britt. & Kearn. Trans. N. Y. Acad. Sci. 14: 23. 1894. *A. longiseta* Steud. var. *fendleriana* Merr. U. S. Dept. Agr. Div. Agrost. Circ. 34: 5. 1901.

14. STIPA L.

Spikelets 1-flowered, in terminal, open or narrow panicles. Glumes narrow, acute or bristle-tipped. Lemma with a bearded sharp-pointed callus, pubescent, indurated, convolute, including the small palea, terminating in a simple, usually stout, geniculate twisted awn. Rather coarse tufted perennials with narrow or involute blades.—Species about 100, throughout the tropical and temperate regions of the world, especially on plains and deserts. (Greek stupa, tow, referring to the feathery awns of some of the species.)

Awn above second bend about 3½ inches long, flexuous ..... 1. *S. comata.*
Awn above second bend not over 1½ inches long, usually much shorter.
  Awn plumose.
    Awn with one bend, very plumose below bend ..... 2. *S. speciosa.*
    Awn with two bends, plumose to second bend.
      Ligule 1½ to 3 lines long ..... 3. *S. thurberiana.*
      Ligule very short.
        Sheaths glabrous ..... 4. *S. occidentalis.*
        Sheaths pubescent ..... 5. *S. elmeri.*
  Awn only scabrous or puberulent.
    Lemma clothed with copious long hairs 2 lines long.
      Awn with two bends; plants 3 feet or more high ..... 6. *S. coronata.*
      Awn usually with one bend; plants 1 to 1½ feet high ..... 7. *S. parishii.*
    Lemma more or less hairy, the hairs not over ½ line long.
      Panicles loose, the branches spreading.
        Terminal segment of awn about 1½ inches long ..... 8. *S. setigera.*
        Terminal segment of awn about ¾ inch long ..... 9. *S. eminens.*

Panicles narrow, the branches erect.
Sheaths hairy at the throat.
Glumes 7 to 8 lines long....10. *S. stillmanii.*
Glumes 5 lines long or less.
Glumes thin and papery, obscurely nerved; panicle slender...11. *S. californica.*
Glumes firm, the first plainly 5 to 7-nerved; panicle rather stout...12. *S. vaseyi.*
Sheaths not hairy at the throat.
Glumes 6 lines long, broad....13. *S. lemmoni.*
Glumes 3 to 4 lines long.
Leaves mostly basal; blades capillary-involute....14. *S. lettermani.*
Leaves scattered; blades flat or involute; culms stouter....15. *S. minor.*

1. **S. comata** Trin. & Rupr. Culms 2 to 4 feet high, smooth; sheaths smooth; ligule 2 to 3 lines long; blades becoming involute, elongated; panicle loose, open, 6 to 10 inches long; branches slender, ascending, or, in anthesis, spreading, the lower 3 to 4 inches long, bearing usually 2 spikelets toward the extremities; glumes nearly an inch long, gradually narrowed into an awn, smooth, 5-nerved, thin, papery; lemma 5 to 6 lines long, rather sparsely appressed-villous; callus 1½ lines long; awn very long, the first section ¾ to 1½ inches long, closely twisted, appressed-villous but becoming nearly smooth, the second like the first but shorter, the third section, as long or longer than the other two, more or less flexuous but not twisted, scabrous, very slender.

From Lake Tahoe (*Hitchcock* 3125) to Argus Mts. (*Purpus* 5461); British Columbia to Mexico, east to Great Plains.

Refs.—Stipa comata Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 5¹: 75. 1842; Thurb. in Wats. Bot. Cal. 2: 285. 1880.

2. **S. speciosa** Trin. & Rupr. Culms numerous, cespitose, 1 to 2 feet high; sheaths smooth, or lower pubescent or even felty at the very base, the throat densely short-villous; ligule short; blades elongated, involute-filiform, mostly basal, more or less deciduous from the outer and older persistent sheaths; panicle narrow, dense, 4 to 6 inches long, not much exceeding the leaves, white or tawny, feathery from the plumose awns; glumes smooth, 7 to 8 lines long, 3-nerved, long-acuminate, papery; lemma 3½ to 4½ lines long, narrow, densely short-pubescent, the callus sharp and smooth below; awn with one sharp bend, the first section ½ to ¾ inch long, densely long-pilose on the lower ½ or ⅔, the hairs 3 to 4 lines long, the remaining portion of the awn scabrous, the second section about 1 inch long.

Central California to Colorado, south into Mexico; also Chile, the type locality. Especially characteristic of the Colorado and Mohave deserts and the deserts north to Mono Lake (*Bolander* 6117); also occurs at Adobe Valley, Stanislaus Co., *Elmer* 4349, and San Luis Obispo, *Lemmon* 5470.

Refs.—Stipa speciosa Trin. & Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 5¹: 45. 1842; Thurb. in Wats. Bot. Cal. 2: 284. 1880; Abrams, Fl. Los Ang. 31. 1904. *S. chrysophylla* Desv. in Gay, Fl. Chil. 6: 278. pl. 76. f. 2. 1853; Thurb. in Wats. Bot. Cal. 2: 285. 1880.

3. **S. thurberiana** Piper. Culms 6 inches to 1½ feet high; sheaths smooth or somewhat scabrous, mostly basal; ligule long, about 1½ to 2 lines long, acute; blades involute, scabrous; panicle 2 to 4 inches long, often subtended by an enlarged sheath; glumes about 6 lines long, acuminate, 3-nerved; lemma 3½ lines long, appressed-pilose, the callus acute; awn about 1½ inches long, indistinctly twice-geniculate, short-pilose to the second bend.

In the mountains, central California to Washington.

Locs.—Yreka, *Butler* 1271; Modoc Nat. For., *Hatton;* Sierra Nevada, *Lemmon;* S. Cal., *G. R. Vasey* in 1880.

Refs.—Stipa thurberiana Piper, U. S. Dept. Agr. Div. Agrost. Circ. 27: 10. 1900. *S. occidentalis* [Thurb. misapplied in] Wilkes, U. S. Expl. Exped. 17: 483. 1874; Thurb. in Wats. Bot. Cal. 2: 285. 1880.

4. **S. occidentalis** Thurb. Culms slender, cespitose, 1 to 2 feet high; sheaths smooth; ligule ½ line long; blades narrow, involute; panicle narrow, 4 to 8 inches long; glumes 4 to 5 lines long, acuminate, 3-nerved, smooth; lemma 3 lines long, long-pilose, the callus sharp; awn about 1 inch long, twice-geniculate, pilose to the second bend or throughout, the first section 3 to 4 lines long.

Sierra Nevada, from Mt. Shasta (*Hitchcock* 2938), southward, also in southern Coast Ranges (Mt. Wilson, *Abrams* 2598); north to Washington and east to Wyoming.

Refs.—Stipa occidentalis Thurb.; Wats. U. S. Geol. Explor. 40th Par. 5: 380. 1871. *S. stricta* Vasey, Bull. Torr. Club 10: 42. 1883. Var. *sparsiflora* Vasey, Contr. Nat. Herb. 3: 51. 1892, type *Bolander* 5038 (from Yosemite Park). *S. occidentalis* Thurb. var. *montana* Merr. & Davy, Univ. Cal. Publ. Bot. 1: 62. 1902, type *Bolander* 5038. *S. oregonensis* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 130. f. 426. 1899.

5. **S. elmeri** Piper & Brodie. Culms 2 to 3 feet high, more or less puberulent, especially at the nodes; sheaths pubescent; ligule very short; blades flat or becoming involute, pubescent on the upper surface, or those of the innovations also on the lower surface; panicle narrow, 6 to 15 inches long, rather loose; glumes 3-nerved, gradually acuminate, thin, papery, 6 to 7 lines long, the first a little the longer; lemma about 3½ lines long, appressed-pubescent, the callus ½ line long, glabrous at the point; awn distinctly twice-geniculate, first section 4 to 5 lines long, second section somewhat shorter, both plumose, third section about 8 to 10 lines long, scabrous.

In the mountains, southern California to Washington.

Locs.—Shasta Nat. For., *Sampson* 171; Upton, *Congdon*; Long Valley, Lassen Co., *Davy*; Yosemite Nat. Park, *Hitchcock* 3247, 3336; Mt. Tallac, *Hitchcock* 3124; Mill Creek Falls, San Bernardino Co., *Parish* 2491; San Jacinto Mts., *Hall* 2537.

Refs.—Stipa elmeri Piper & Brodie, U. S. Dept. Agr. Div. Agrost. Bull. 11: 46. 1898. *S. viridula* Trin. var. *pubescens* Vasey, Contr. Nat. Herb. 3: 50. 1892.

6. **S. coronata** Thurb. Culms stout, 4 to 6 feet high, as much as ¼ inch thick at base, smooth or pubescent below the nodes; sheaths smooth, the margin and throat villous; ligule about 1 line long, ciliate-margined; blades very long, flat, with a slender involute point; paniele narrow, dense, stout, purplish, 1 to 1½ feet long; glumes gradually acuminate, 3-nerved, smooth except the scabrous keel of the first, unequal, the first about 10 lines long, the second 1 to 2 lines shorter; lemma about 4 lines long, densely villous with long appressed hairs; awn twice-geniculate, first section about 5 lines long, twisted, scabrous but not villous, second section similar but shorter, third section about as long as the other two, straight.

Coast Ranges, Monterey Co. southward, extending into Lower California.

Locs.—Cone Peak, Monterey Co., *Davy* 7716; Pico Blanco, *Davy* 7345; Tassajara Hot Springs, *Elmer* 3302; San Bernardino Co., *Parish* 3665; Los Angeles Co., *Abrams* 623, 1305, *Leiberg* 3336; Riverside Co., *Baker* 5282, *Hall* 2078; San Diego Co., *Abrams* 3360, *Orcutt* 1068.

Refs.—Stipa coronata Thurb. in Wats. Bot. Cal. 2: 287. 1880; Abrams, Fl. Los Ang. 30. 1904.

7. **S. parishii** Vasey. Culms stout, 1 to 2 feet high; sheaths smooth, villous at the throat; ligule short, ciliate; blades firm, flat, with a slender involute point, very scabrous above, about 2 lines wide; panicle 6 to 8 inches long, narrow, dense, purple-tinged; glumes smooth, 3-nerved, long-acuminate, unequal, the first 7 lines long, the second a line shorter; lemma 3½ lines long,

densely long-villous, especially above; awn about an inch long, once-geniculate, twisted below, straight above, nearly smooth.

Southern California and western Nevada.

Locs.—San Bernardino Mts., *Hall* 7580, *Parish Bros.* 1079, 1079a, *Parish* 2487, 3287, *Wilder* 1127; San Jacinto Mts., *Hall* 2309; Jamacha Hot Springs, *Abrams* 3637.

Refs.—STIPA PARISHII Vasey, Bot. Gaz. 7: 33. 1882, type *Parish Bros.* 1079; Abrams, Fl. Los Ang. 30. 1904.

8. **S. setigera** Presl. Culms 2 to 3 feet high; blades long and narrow, flat or involute; ligule about ½ line long; panicle about 6 inches long, loose, the branches spreading, slender, some of the lower 1 to 2 inches long; glumes narrow, long-acuminate, purplish, 3-nerved, unequal, the first about 10 lines long, the second 1 or 2 lines shorter; lemma 4 lines long, sparingly pilose, the callus sharp; awn 2 to 3 inches long, short-pubescent to the second bend, the first section ½ to ¾ inch long, the second shorter, the third slender and flexuous.

Mostly in the Coast Ranges, Walker Valley (*Davy & Blasdale* 5041) to San Diego (*Baker* 833) and Santa Barbara Islands (*Trask*), eastward to Susanville (*Brandegee*), Amador Co. (*Hansen* 1668), Northfork (*Griffiths* 4601), and Winchester (*Hall* 2921); east to Texas and south into Mexico. Historic specimens referred here are: *Bolander* 4802, *Bigelow* (Whipple Expl.), *Brewer* 1262, *Hartweg* 2028, *Kellogg & Harford* 1096, *Lemmon* 5452, 5455, 5472, *Parish Bros.* 1550, 1554, *Parish* 2038, *Torrey* 759.

Refs.—STIPA SETIGERA Presl, Rel. Haenk. 1: 226. 1830; Thurb. in Wats. Bot. Cal. 2: 286. 1880; Davy in Jepson, Fl. W. Mid. Cal. 38. 1901; Abrams, Fl. Los Ang. 31. 1904. *S. necsiana* [Trin. & Rupr. misapplied by] Torr. U. S. Rep. Expl. Miss. Pacif. 4: 154. 1857.

9. **S. eminens** Cav. Culms slender, puberulent below the nodes, 2 to 3 feet high; sheaths smooth, sparingly villous at throat; ligule very short; blades flat, narrow, 1 to 2 lines wide, pubescent on upper surface near base; paniele rather loose and open, usually 6 to 8 inches long, but sometimes more than 1 foot long, the branches distant, slender; glumes 3-nerved, smooth, unequal, acuminate, the first 3 to 5 lines long, the second about 1 line shorter; lemma about 3 lines long, sparingly villous, nearly glabrous toward the hairy-tufted apex; awn indistinctly twice-geniculate, about 1 to 1½ inches long, seabrous but not villous.

Coast Ranges from Berkeley Hills (*Davy* 4235) to San Diego (*Orcutt* 1065), east to San Bernardino (*Parish* 2055); south into Lower California and east to Texas and Mexico.

Var. **andersoni** Vasey. Differs from S. eminens chiefly in the slender involute blades. This form is, on the average, a smaller plant, the culms being shorter, the panieles narrower and few-flowered, the spikelets usually smaller.—Confined to California, where the range is about the same as that of S. eminens but extending north to Mt. Shasta (*Jepson* in 1895).

Refs.—STIPA EMINENS Cav. Icon. Pl. 5: 42. pl. 467. f. 1. 1799; Thurb. in Wats. Bot. Cal. 2: 286. 1880; Abrams, Fl. Los Ang. 30. 1904. Var. ANDERSONI Vasey, Contr. Nat. Herb. 3: 54. 1892, type from Santa Cruz, *Anderson*, according to the label on the type specimen in the National Herbarium (the type locality, "Lower California", as published, evidently an error); Davy in Jepson, Fl. W. Mid. Cal. 38. 1901. *S. hassei* Vasey, Contr. Nat. Herb. 1: 267. 1893, type from Santa Monica, *Hasse*, a specimen deformed by smut; Abrams, Fl. Los Ang. 29. 1904.

S. PRINGLEI Scribn. Culms 2 to 3 feet high; blades flat, firm, smooth, coarsely nerved; ligule 1 line long; panicle open, the branches few-flowered; glumes 5 lines long; lemma nearly as long as glumes, sparingly pilose; awn about ¾ inch long, twice-geniculate, incurved, nearly smooth.—There are two specimens of

this species collected by Lemmon, one in 1882, marked "California," the other in 1884, no. 394, the locality not given. It is doubtful, however, if this species occurs in California. These specimens are probably from Arizona.

10. **S. stillmanii** Boland. Culms stout, 2 to 3 feet high; sheaths smooth, puberulent at the throat and collar; ligule very short; blades scattered, folded or involute, firm, the uppermost filiform; paniele narrow, dense or interrupted at base, the branches short, fascieled; glumes equal, papery, minutely scabrous, acuminate into a scabrous awn-point, 7 to 8 lines long, the first 3-nerved, the second 5-nerved; lemma 4½ lines long, short-pilose, the callus short; awn about 1 inch long, once or indistinctly twice-geniculate, scabrous.

Only known from the collection of Bolander, from Blue Cañon, Placer Co. (the type). Three other sheets in the National Herbarium, presumably of the same collection, are labeled from the Sierra Nevada, altitude 4000 feet.

Refs.—Stipa stillmanii Boland. Proc. Cal. Acad. 4: 169. 1873; Thurb. in Wats. Bot. Cal. 2: 287. 1880.

11. **S. californica** Merr. & Davy. Culms 2 to 5 feet high, smooth, or the nodes pubescent; sheaths smooth, villous at the throat; ligule very short; blades flat, becoming involute, especially at the long slender point; paniele narrow, usually 1 to 1½ feet long; branches fascieled, short, appressed, or some of the lower as much as 5 inches long; glumes thin and papery, equal, about 5 lines long, smooth, 3-nerved, the lateral nerves rather indistinct; lemma about 3 lines long, appressed-villous; awn twice-geniculate, the first section 3 to 5 lines long, closely twisted, villous, the second section shorter, 2 to 3 lines long, twisted, villous, the third section 5 to 8 lines long, straight, scabrous only and lighter in color.

Sierra Nevada from Mt. Shasta to Yosemite, and in the San Jacinto Mts.

Locs.—Mt. Shasta, *Hitchcock* 2948; Castle Crag, *Hitchcock* 3064; Shasta Retreat, *Heller* 7936; Donner Lake, *Torrey* 578; Mt. Tallac, *Hitchcock* 3121, 3159; Yosemite Nat. Park, *Bolander* 6109, *Hall & Babcock* 3336.

Refs.—Stipa californica Merr. & Davy, Univ. Cal. Publ. Bot. 1: 61. 1902, type from the San Jacinto Mts., *Hall* 2556. This appears to be the species described under *S. viridula* Trin. by Davy in Jepson, Fl. W. Mid. Cal. 39. 1901, and Abrams, Fl. Los Ang. 31. 1904.

12. **S. vaseyi** Scribn. Culms 2 to 3 feet high; sheaths somewhat hairy at the throat; blades elongated, involute; paniele about 1 foot long, dense, the branches and branchlets numerous, many-flowered; glumes narrow, acuminate, scabrous, the first a little longer, rather strongly 5 to 7-nerved, 5 lines long; lemma about 3 lines long, appressed-pilose, the callus short, pilose; awn twice-geniculate, about 1 inch long, minutely puberulent.

Texas to Colorado and Arizona, south into Mexico. There is but one specimen of this from California (San Nicholas Island, *Trask*), consisting of a panicle and one leaf, which differs from the type from Texas, in having a longer awn and a more distinctly nerved glume.

Refs.—Stipa vaseyi Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 46. 1898. *S. viridula* Trin. var. *robusta* Vasey, Contr. Nat. Herb. 3: 50. 1892.

13. **S. lemmoni** Scribn. Culms 2 to 3 feet high, sometimes pubescent below the nodes; sheaths smooth; ligule about ½ line long; blades usually flat, pubescent on upper surface; paniele narrow, the branches 1 to 2 inches long, appressed; glumes nearly equal, rather broad, scarious, acuminate, 3 to 5-nerved, 6 lines long; lemma 3½ lines long, rather thinly appressed-pilose, the callus short; awn about 1 inch long, twice-geniculate, appressed-pilose to the second bend.

In the Sierra Nevada (Moffat Creek, Siskiyou Co., *Butler* 830) to Tehachapi (*Chase* 5731) and in the Coast Ranges (Red Mt., Humboldt Co., *Bolander* 6469) to Mendocino Co. (*Davy & Blasdale* 5287); north to Washington.

Var. **jonesii** Scribn. Differs in the more slender firm involute blades, and smaller spikelets; glumes about 4 lines long; lemma about 3 lines long, the awn ¾ inch long, tending to be incurved, the pubescence shorter.—Washington and Idaho to California. Yreka, *Butler* 810; Sierra Nevada as far south as Mariposa Co. (*Bolander* 4865); also in the mountains of San Diego Co. (*Brandegee* 129).

Refs.—STIPA LEMMONI Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 3. 1901. *S. pringlei* Scribn. var. *lemmoni* Vasey, Contr. Nat. Herb. 3: 541. 1892, type from Plumas Co., *Lemmon* 5456. Var. JONESII Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 4. 1901, type from Emigrant Gap, *Jones* 3298.

14. **S. lettermani** Vasey. Culms cespitose, slender, 1 to 1½ feet high; sheaths smooth; ligule very short; blades crowded at base of plant, short, slender, involute; panicle narrow, 3 to 8 inches long; glumes narrow, acuminate, 3-nerved, about 4 lines long; lemma narrow, 2½ lines long, pilose; awn very slender, about ½ inch long, nearly smooth, twice-geniculate, the first section short, about 1½ lines long.

California to Idaho and Colorado.

Locs.—Lincoln Valley, Sierra Co., *Kennedy & Doten* 215; Truckee, *Hitchcock;* San Bernardino Mts., *Parish Bros.* 1552.

Refs.—STIPA LETTERMANI Vasey, Bull. Torr. Club 13: 53. 1886. *S. viridula* Trin. var. *lettermani* Vasey, Contr. Nat. Herb. 3: 50. 1892.

15. **S. minor** Scribn. Culms few in a cluster, 2 to 3 feet high; sheaths smooth; ligule very short; blades flat or becoming involute, narrow, as much as 1 foot long; panicle narrow, 6 to 8 inches long; glumes 3 lines long, 3-nerved, slightly scabrous on the keels; lemma narrow, pilose, 2½ lines long; awn about ½ inch long, nearly smooth, twice-geniculate, the first section 1½ lines long.

High Sierra Nevada of central California; probably also in Mexico. Differs from S. lettermani only in being larger, the blades more scattered, flat or tardily involute, and the panicles longer.

Locs.—Summit Valley, *Pringle;* Yosemite Nat. Park, *Bolander* 5078, *Hitchcock* 3304, 3324; Farewell Gap, *Hitchcock* 3393.

Refs.—STIPA MINOR Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 46. 1898. *S. viridula* Trin. var. *minor* Vasey, Contr. Nat. Herb. 3: 50. 1892. *S. viridula* as described by Thurb. in Wats. Bot. Cal. 2: 288. 1880, appears to include *S. minor, S. lettermani, S. californica* and *S. lemmoni.*

15. **ORYZOPSIS** Michx.

Spikelets 1-flowered, in narrow or open panicles. Glumes rather broad, obtuse or abruptly acute. Lemma with a short obtuse callus, convolute, somewhat indurated, including the rather large palea, terminating in a simple slender, usually short, deciduous awn. Perennials.—Species about 15 in temperate regions of the northern hemisphere. (Greek orusa, rice, and opsis, appearance.)

Lemma smooth; spikelets numerous, 1½ lines long; blades flat.....1. *O. miliacea.*
Lemma pilose; blades involute.
  Branches of panicle and capillary pedicels divaricately spreading.....2. *O. hymenoides.*
  Branches of panicle and pedicels erect or ascending.
    Glumes about 2 lines long; lemma sparingly pilose.....3. *O. kingii.*
    Glumes 4 to 5 lines long; lemma densely long-pilose.
      Awn 3 lines long; culms 6 inches to 1 foot high.....4. *O. webberi.*
      Awn 6 lines long; culms 1 to 2 feet high.....5. *O. bloomeri.*

1. **O. miliacea** Benth. & Hook. Culms erect from a decumbent base, 2 to 3 feet high; sheaths smooth; ligule about 1 line long; blades flat, 4 to 5 lines wide; panicle as much as a foot long, loose, the branches spreading; glumes 1½ lines long, smooth, equal; lemma smooth, 1 line long, the deciduous straight awn about 2 lines long.

A native of Europe, introduced in a few localities in California. Cahto, Mendocino Co., *Davy* 6624; Santa Barbara, *Grant* 5388; Los Angeles, *McClatchie* 1222.

Refs.—Oryzopsis miliacea Benth. & Hook.; Aschers. & Schweinf. Mém. Inst. Égypte 2: 169. 1887. *Agrostis miliacea* L. Sp. Pl. 61. 1753.

2. **O. hymenoides** Ricker. Culms cespitose, 1 to 2 feet high; sheaths smooth or minutely scabrous; ligule about 3 lines long, acute; blades slender, elongated, nearly as long as the culms; panicle diffuse, 3 to 6 inches long, the slender branches in pairs, the branchlets dichotomous, all divaricately spreading, the ultimate pedicels capillary, flexuous, enlarged below the spikelets; glumes equal, about 3 lines long, puberulent, papery, ovate, 3-nerved, abruptly narrowed into an awn-like point; lemma fusiform, turgid, about 1½ lines long, nearly black at maturity, densely long-pilose with hairs 1½ lines long; awn when present about 2 lines long, straight, readily deciduous.

Deserts and plains of the southern portion of the state, rare northward to Mt. Shasta (*Hall & Babcock* 4093); Washington to Manitoba, south to Mexico.

Refs.—Oryzopsis hymenoides Ricker; Piper, Contr. Nat. Herb. 11: 109. 1906. *Stipa hymenoides* Roem. & Schult. Syst. Veg. 2: 239. 1817. *Eriocoma cuspidata* Nutt. Gen. 1: 40. 1818; Thurb. in Wats. Bot. Cal. 2: 283. 1880.

3. **O. kingii** Beal. Culms tufted, slender, 8 to 15 inches high; blades numerous at the base of the plant, involute, capillary; ligule about ½ line long; panicle narrow, loose, the short slender branches appressed or ascending, few-flowered; glumes broad, papery, nerveless, obtuse, purple at base, unequal, the first about 1¾ lines long, the second a little longer; lemma elliptical, 1½ lines long, rather sparingly appressed-pubescent, the callus short; awn more or less sickle-shaped, bent in a wide curve or indistinctly geniculate below the middle, not twisted, minutely pubescent, not readily deciduous, about ½ inch long.

Only known from the high central Sierra Nevada.

Locs.—Upper Tuolumne, *Bolander* 6097; Lyell Fork Cañon, *Hitchcock* 3289; Clouds Rest, *Congdon;* Black Mt., Fresno Co., *Hall & Chandler* 601.

Refs.—Oryzopsis kingii Beal, Grasses N. Am. 2: 229. 1896. *Stipa kingii* Boland. Proc. Cal. Acad. 4: 170. 1872, type from Mt. Dana, *Bolander* 6097 (the number given with the original description is 6076, but all the original specimens distributed under *Stipa kingii* are numbered 6097, and this is the number found in Bolander's Field Book for the Mt. Dana collection of *Stipa kingii);* Thurb. in Wats. Bot. Cal. 2: 287. 1880.

4. **O. webberi** Benth. Culms cespitose, erect, 6 inches to 1 foot high; blades involute, filiform, scabrous; panicle narrow, 1 to 2 inches long, the branches appressed; glumes equal, narrow, obscurely 5-nerved, minutely scaberulous, acuminate, about 4 lines long; lemma narrow, 3 lines long, densely long-pilose, the awn about 3 lines long, straight or bent, not twisted.

Deserts and plains; Lassen Co. (Smoke Creek, *Griffiths & Hunter* 485) to Colorado.

Refs.—Oryzopsis webberi Benth.; Vasey, Grasses U. S. 23. 1883. *Eriocoma webberi* Thurb. in Wats. Bot. Cal. 2: 283. 1880, type from Sierra Valley, *Bolander.*

5. **O. bloomeri** Ricker. Culms tufted, 1 to 2 feet high, glabrous; sheaths glabrous; ligule about ½ line long; blades crowded at the base, involute, nar-

row, firm; panicle 3 to 6 inches long, the branches slender, rather stiffly ascending, the longer 2 to 3 inches long, bearing spikelets from about the middle; glumes comparatively broad, indistinctly 3 to 5-nerved, smooth, rather abruptly acuminate, equal, 4 to 5 lines long; lemma elliptical, 2½ lines long, densely long-villous; awn about ½ inch long, tardily deciduous, once-geniculate, the first section about 3 lines long, slightly twisted, appressed-villous, indistinctly bent or flexuous, the second section straight, minutely scabrous.

Dry regions, Washington to Manitoba and south to New Mexico.

Locs.—Moulton, Modoc Co., *Griffiths & Hunter* 456; Mt. Diablo, *Bolander;* Lancaster, *Elmer* 4165.

Refs.—Oryzopsis bloomeri Ricker; Piper, Contr. Nat. Herb. 11: 109. 1906. *Stipa bloomeri* Boland. Proc. Cal. Acad. 4: 168. 1872, type from Mono Pass, *Bolander* 6116. *S. siberica* [Lam. misapplied by] Thurb. in Wats. Bot. Cal. 2: 287. 1880.

16. MUHLENBERGIA Schreb.

Spikelets 1-flowered. Glumes thin, 1-nerved, often aristate. Lemma with a short, often barbate callus, narrow, membranaceous, 3-nerved, acute, mucronate, or often awned from the tip or from between the teeth of the bidentate apex. Palea thin, about as long as lemma. Annual or usually perennial grasses, the inflorescence varying from an open and diffuse, to a narrow and spike-like panicle.—Species about 60, mostly American, especially abundant on the Mexican plateau. (Rev. Dr. Henry Muhlenberg, a distinguished American botanist, 1753—1815.)

Hairs at base of floret at least half as long as body of lemma; panicle narrow; perennials.
  Hairs at base of floret copious, as long as body of lemma.....1. *M. comata.*
  Hairs at base of floret not over ½ as long as body of lemma.
    Panicle loose; upper glume 3-toothed; blades involute.....2. *M. gracilis.*
    Panicle close; glumes entire; blades flat.
      Blades narrow, about 1 line wide.....3. *M. lemmoni.*
      Blades broad, 1½ to 2½ lines wide.....4. *M. californica.*
Hairs at base of floret minute or wanting.
  Glumes erose-toothed; culms erect; plants perennial, without rhizomes.....7. *M. jonesii.*
  Glumes entire; culms mostly decumbent or spreading; plants perennial with rhizomes, or annual.
    Lemma awned, the awn 3 lines long or more.
      Plants annual; panicle narrow; awn 5 to 7 lines long.....5. *M. microsperma.*
      Plants perennial; panicle diffusely spreading; awn 3 lines long.....6. *M. porteri.*
    Lemma unawned, mucronate; panicles narrow.
      Culms capillary; plants lax and soft, no creeping rootstocks, often annual; blades flat.....8. *M. filiformis.*
      Culms stouter, rather woody or wiry; rootstocks creeping; blades involute.
        Plants widely spreading or creeping; glumes ¾ line long.....9. *M. repens.*
        Plants erect or decumbent at base; glumes ½ line long.....10. *M. squarrosa.*

1. **M. comata** Thurb. Perennial, with numerous scaly rhizomes; culms erect or sometimes spreading, smooth below, scabrous above, pubescent about the nodes, 1½ to 3 feet high; sheaths smooth or slightly scabrous, keeled; ligule ½ line long, membranaceous, short-ciliate; blades flat, 1 to 3 lines wide, scabrous; panicles narrow, spike-like, usually more or less lobed or interrupted, often purple-tinged, 3 to 6 inches long; glumes narrow, acuminate, 1-nerved, smooth, ciliate-scabrous on the keels, 1½ to 2 lines long; lemma 1½ lines long, gradually narrowed into a capillary awn 2 to 4 lines long, the hairs at base of floret copious, 1 to 1½ lines long.

Mt. Shasta south through the Sierra Nevada to the San Bernardino Mts. In the mountains from Washington to Wyoming and south to Colorado.

Locs.—Mt. Shasta, *Pringle;* Castle Crag, *Hitchcock* 3078; Sierra Valley, *Lemmon* 5475; Mono Lake, *Bolander* 6094; Yosemite Nat. Park, *Bolander* 6094a, 6101, *Hitchcock* 3213; Mt. Dana, *Bolander;* Sequoia Nat. Park, *Hitchcock* 3376, 3377; San Bernardino Mts., *Abrams* 2906.

Refs.—MUHLENBERGIA COMATA Thurb.; Benth. in Jour. Linn. Soc. Bot. 19: 83. 1881. *Vaseya comata* Thurb. in Gray, Proc. Acad. Phila. 1863: 79. 1863; Thurb. in Wats. Bot. Cal. 2: 278. 1880.

2. **M. gracilis** Trin. Perennial; culms densely cespitose, erect from a short decumbent rhizomatous base, smooth or scabrous above, 6 to 18 inches high; sheaths smooth or scabrous; ligule 2 to 3 lines long; blades crowded at base, involute, scabrous, sharp-pointed; panicles narrow, loose, 2 to 4 inches long; glumes broad, oblong, sparsely pubescent, 1 line long, obtuse or more or less erose at apex, the second 3-toothed; lemma 1½ lines long, sparsely pubescent at base and margins, gradually narrowed into a slender, more or less flexuous awn ½ to ¾ inch long.

Dry ground, middle Sierra Nevada (Yosemite Valley, *Bolander* 6093; Mt. Tallac, *Hitchcock* 3143) to Wyoming, south into Mexico.

Refs.—MUHLENBERGIA GRACILIS Trin. Gram. Unifl. 193. 1824; Thurb. in Wats. Bot. Cal. 2: 277. 1880. *Podosacmum gracile* H.B.K. Nov. Gen. & Sp. 1: 131. 1816.

3. **M. lemmoni** Scribn. Perennial, from a creeping branching woody rhizome; culms slender, wiry, erect or ascending, 1 to 2 feet high; blades flat or somewhat involute, ½ to 1 line wide; panicles narrow, interrupted, the branches short; glumes narrow, gradually acuminate, including the awn about 1½ lines long; lemma 1½ lines long, acuminate into an awn as much as 3 lines long, the callus hairs rather sparse, about ½ as long as body of lemma.

Deserts from southern California (Jamacha, *Canby* 58) to Texas and northern Mexico.

Ref.—MUHLENBERGIA LEMMONI Scribn. Contr. Nat. Herb. 1: 56. 1890.

4. **M. californica** Vasey. Perennial, the base more or less creeping and rhizomatous; culms erect, somewhat woody below, smooth, puberulent about nodes, 1 to 2 feet high; sheaths scaberulous, keeled; ligule scarcely ½ line long; blades flat, 2 to 3 lines wide, scabrous, usually short; panicles narrow, spike-like or interrupted, 3 to 6 inches long; glumes narrow, acuminate or awn-pointed, 1½ to 2 lines long, scabrous on the keels; lemma about 1½ lines long, scabrous, the callus hairs rather sparse, about ½ as long as lemma; awn a line long or less.

Confined to southern California.

Locs.—Mt. Lowe, *Chase* 5555; Rialto, *Parish* 2113; San Bernardino Mts., *Parish Bros.* 1076, 1628; San Diego, *Orcutt.*

Refs.—MUHLENBERGIA CALIFORNICA Vasey, Bull. Torr. Club 13: 53. 1886; Abrams, Fl. Los Ang. 32. 1904. *M. glomerata* Trin. var. *brevifolia* Vasey, Bot. Gaz. 7: 92. 1882, type *Parish Bros.* 1028. *M. parishii* Vasey, Bull. Torr. Club 13: 53. 1886, type *Parish Bros.* 1076 (the glumes extended into awns ½ line long). *M. sylvatica* Torr. var. *californica* Vasey, Bot. Gaz. 7:*93. 1882, type *Parish Bros.* 1076.

5. **M. microsperma** Trin. Annual, often purple; culms spreading, 6 to 15 inches high, scaberulous especially below the nodes; sheaths smooth or scaberulous; ligule ½ line long; blades 1 to 2 inches long, ½ line wide, flat, scabrous; panicles narrow, loose, 1 to 3 inches long; glumes ovate, obtuse or emarginate, 1-nerved, unequal, the second the longer, ½ line long; lemma narrow, acuminate, 3-nerved, 1½ lines long, appressed-pubescent on margins and callus; awn terminal, capillary, 5 to 7 lines long.—Cleistogamous spikelets are developed at the base of the lower sheaths. These are solitary or few in a fascicle in each axil, each spikelet included in the indurated thickened,

tightly rolled prophyllum. The glumes are wanting and awn of the lemma reduced, but the grain is larger than that of the spikelets in the terminal inflorescence, being about the same length (1 line) but much thicker. The prophyllum enclosing the spikelet is narrowly conical and readily disarticulates from the plant at maturity.

Open ground from middle and southern California to Arizona and northern Mexico. Carmel Bay (*Elmer* 5085) and San Luis Obispo (*Brewer* 466) southward, extending east to Kern Cañon (*Heller* 7654) and The Needles (*Chase* 5792).

Refs.—MUHLENBERGIA MICROSPERMA Trin. Gram. Unifl. 193. 1824 (by inference only); Kunth, Rév. Gram. 1: 64. 1829. *Trichochloa microsperma* DC. Cat. Pl. Monsp. 151. 1813. *Muhlenbergia debilis* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 295. 1840; Thurb. in Wats. Bot. Cal. 2: 277. 1880; Abrams. Fl. Los Ang. 32. 1904. *Podosaemum debile* H.B.K. Nov. Gen. & Sp. 1: 128. 1816.

6. **M. porteri** Scribn. Perennial; culms woody or persistent at base, numerous, wiry, widely spreading or ascending through bushes, scaberulous, more or less branched from all the nodes, 1 to 3 feet long or more; sheaths smooth, spreading away from the branches, the prophyllum conspicuous; blades small, flat, 1 to 2 inches long, early deciduous from the sheath; panicles 2 to 4 inches long, open, the slender branches and branchlets brittle, widely spreading, bearing rather few, long-pediceled spikelets; glumes narrow, acuminate, slightly unequal, the second longer, about 1 line long; lemma purple, acuminate, minutely pilose, 1½ to 2 lines long, the awn about 3 lines long.

Rocky deserts from southern California (San Felipe, San Diego Co., *Parish Bros.* 1529) to Texas and northern Mexico.

Ref.—MUHLENBERGIA PORTERI Scribn.; Beal, Grasses N. Am. 2: 259. 1896.

7. **M. jonesii** Hitchc. n. comb. Perennial; culms cespitose, erect, slender, about 1 foot high; blades mostly basal, involute, flexuous, scabrous; panicles narrow, loose, 2 to 3 inches long; glumes equal, obtuse, toothed at apex, a little more than ½ line long; lemma 2 lines long, acuminate, awn-pointed.

Only known from northeastern California.

Locs.—Mt. Shasta, *Palmer* 2640 in 1892; Warner Valley, *Austin* 1230; Silver Lake, *Baker & Nutting;* Prattville, *Jones;* French Meadows, Placer Co., *Kennedy & Doten* 408.

Refs.—MUHLENBERGIA JONESII Hitchc. *Sporobolus jonesii* Vasey, Bot. Gaz. 6: 297. 1881, type from Soda Springs, *Jones* in 1881.

8. **M. filiformis** Rydb. Annual or sometimes apparently perennial, rather soft and lax, spreading from a cluster of fibrous roots or with decumbent creeping, apparently perennial bases; culms capillary, a few inches to as much as a foot high, often depauperate; blades flat, usually less than an inch long; panicles narrow, interrupted, few-flowered, an inch long or less; glumes ovate, ½ line long; lemma lanceolate, acute, mucronate, 1 line long, minutely pubescent, scaberulous at tip.

Mountain meadows from Siskiyou Co. (*Butler* 1768) south through the Sierra Nevada to Sequoia Nat. Park (*Hitchcock* 3420). San Bernardino Mts. (*Parish* 2101, 3293), and San Jacinto Mts. (*Hall* 2290); Washington to Montana and southward in the mountains to Arizona.

Refs.—MUHLENBERGIA FILIFORMIS Rydb. Bull. Torr. Club 32: 600. 1905. *Vilfa depauperata* Torr. var. *filiformis* Thurb.; Wats. King's Expl. 376. 1871. *V. gracillima* Thurb. in Wats. Bot. Cal. 2: 268. 1880 (based upon two specimens, Sierra Nevada, *Brewer*, and Yosemite Valley, *Bolander*), not *Muhlenbergia gracillima* Torr. 1856. *Sporobolus filiformis* Rydb. Contr. Nat. Herb. 3: 189. 1895.

9. **M. repens** Hitchc. n. comb. Perennial from woody creeping rhizomes;

culms slender, wiry, widely spreading or creeping, 6 to 15 inches long, flower-bearing branches ascending; blades involute, arcuate, ½ to 1½ inches long; panicles narrow, interrupted, few-flowered, ½ to 1 inch long; glumes ovate, acute, ¾ line long, smooth; lemma exceeding the glumes, about 1 line long, smooth or sparsely pubescent, acute or mucronate.

Deserts of Inyo Co. (Funeral Mts., *Coville & Funston* 228), and of Arizona and northern Mexico.

Refs.—MUHLENBERGIA REPENS Hitchc. *Sporobolus repens* Presl, Rel. Haenk. 1: 241. 1830.

10. **M. squarrosa** Rydb. Perennial from numerous hard creeping rhizomes; culms wiry, erect or decumbent at base, from a few inches to as much as 2 feet in height; blades flat or usually involute, ½ to 2 inches long; panicle narrow, interrupted, or sometimes rather close and spike-like, 1 to 6 inches long; glumes ovate, ½ line long; lemma lanceolate, acute, mucronate, 1 line long.

Dry ground, from Lake Tahoe region (Donner Lake, *Heller* 7040) to San Jacinto Mts. (*Hall* 786, 2477); Washington to Montana, south to Mexico.

Refs.—MUHLENBERGIA SQUARROSA Rydb. Bull. Torr. Club 36: 531. 1909. *Vilfa squarrosa* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4: 100. 1840. *V. depauperata* Torr.; Hook. Fl. Bor. Am. 2: 257. 1840, not *Muhlenbergia depauperata* Scribn.; Thurb. in Wats. Bot. Cal. 2: 267. 1880. *Sporobolus depauperatus* Scribn. Bull. Torr. Club 10: 63. 1883.

17. **CRYPSIS** Ait.

Spikelets 1-flowered, in close depressed heads, subtended by 2 inflated sheaths with thorn-like blades. Glumes obtuse. Lemma and 1-nerved palea, white, membranaceous, longer than the glumes. Much branched, spreading annual.—Species 1, Mediterranean region, introduced elsewhere. (Greek krupsis, hiding, from the partially concealed inflorescence.)

1. **C. aculeata** Ait. Plants prostrate, a foot in diameter, or often depauperate, only an inch or two wide; glumes about 1½ lines long, minutely hispid, about equal in length, the first narrower; lemma about as long as the glumes, scabrous on keel.

In overflowed land of the interior valley: Norman, Colusa Co., *Davy;* Stockton, *K. Brandegee.*

Refs.—CRYPSIS ACULEATA Ait. Hort. Kew. 48. 1789. *Schoenus aculeatus* L. Sp. Pl. 42. 1753.

18. **PHLEUM** L.

Spikelets 1-flowered, flattened, in dense cylindrical spike-like panicles. Glumes equal, ciliate on the keels, abruptly awn-pointed. Lemma shorter than the glumes, truncate, hyaline, 5-nerved. Palea narrow, about equaling the lemma. Erect perennials with flat blades.—Species 10, temperate and cool regions of the world, 1 a native of America. (Greek phleos, a kind of reed.)

Heads cylindrical, several times longer than wide.....1. *P. pratense.*
Heads ovoid or oblong, 1½ to 2 times as long as broad.....2. *P. alpinum.*

1. **P. pratense** L. TIMOTHY. Culms 2 to 4 feet high, from a swollen or bulb-like base; panicles long-cylindrical, 1 to 4 inches long; awn of glumes ½ line long.

Commonly escaped from cultivation, along roadsides and in fields and waste places.

Refs.—PHLEUM PRATENSE L. Sp. Pl. 59. 1753; Thurb. in Wats. Bot. Cal. 2: 262. 1880; Davy in Jepson, Fl. W. Mid. Cal. 39. 1901; Abrams, Fl. Los Ang. 33. 1904.

2. **P. alpinum** L. Culms 8 inches to 1½ feet high, from a decumbent, some-

what creeping base; panicles ellipsoidal or short-cylindrical; awn of glumes 1 line long, giving the head a bristly appearance.

Common in mountain meadows, bogs and swamps, in the high Sierra Nevada, and in the Coast Ranges as far south as Mendocino Co.; also in the San Jacinto Mts. Throughout the cooler regions of Eurasia and North America and extending south in the mountains to Mexico and South America.

Refs.—PHLEUM ALPINUM L. Sp. Pl. 59. 1753; Thurb. in Wats. Bot. Cal. 2: 263. 1880; Davy in Jepson, Fl. W. Mid. Cal. 40. 1901.

19. **ALOPECURUS** L.

Spikelets 1-flowered, flattened, falling from the axis entire, in dense cylindrical spike-like panicles. Glumes equal, awnless, usually connate at base, ciliate on the keel. Lemma broad, obtuse, 5-nerved, about as long as glumes, bearing a slender erect dorsal awn from below the middle, the margins connate near the base. Palea none. Slender annual or perennial grasses, with flat blades and soft panicles.—Species about 20, temperate regions, mostly the northern hemisphere. (Greek alopex, fox, and oura, tail.)

Spikelets 1½ lines long; panicle oblong, 3 lines wide.....1. *A. californicus.*
Spikelets 1 line long; panicle narrow, linear, 2 lines wide.
Awn scarcely protruding.....2. *A. aristulatus.*
Awn protruding about 1 line.....3. *A. geniculatus.*

1. **A. californicus** Vasey. Culms 6 inches to 2 feet high; sheaths inflated; panicles oblong, 1 to 2 inches long, about 3 lines wide; glumes 1½ lines long; lemma sparsely pilose on the sides, the awn exserted about 1½ lines.

Meadows and wet places, mostly in the Coast Ranges from Willits (*Davy* 6556) to San Diego (*Brandegee* 3677); also in Merced Co. (*Congdon*). Alaska to Montana and the mountains of Arizona.

Refs.—ALOPECURUS CALIFORNICUS Vasey, Bull. Torr. Club 15: 13. 1888, type from Santa Cruz, *Anderson* in 1887; Davy in Jepson, Fl. W. Mid. Cal. 41. 1901. *A. pratensis* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 263. 1880.

A. PRATENSIS L., the cultivated Meadow Fox-tail, is reported by Davy (Jepson, Fl. W. Mid. Cal. 40. 1901) as being occasionally naturalized. It resembles A. californicus but has larger spikelets, about 3 lines long.

2. **A. aristulatus** Michx. Culms erect or spreading, 6 inches to 2 feet high: panicles narrow-cylindrical, 1 to 3 inches long, about 2 lines wide; glumes 1 line long; awn of lemma short, scarcely exserted.

In water and wet places throughout the California mountains; common in the cooler parts of North America.

Refs.—ALOPECURUS ARISTULATUS Michx. Fl. Bor. Am. 1: 43. 1803; Thurb. in Wats. Bot. Cal. 2: 263. 1880. *A. geniculatus* L. var. *aristulatus* Torr. Fl. North. & Mid. U. S. 97. 1823; Davy in Jepson, Fl. W. Mid. Cal. 41. 1901.

3. **A. geniculatus** L. Differs from A. aristulatus in being more or less decumbent at base, and in having a longer awn exserted about 1 line.

In water and wet places, the cooler parts of America and Eurasia, rare in California. San Diego, *Abrams* 3448.

Refs.—ALOPECURUS GENICULATUS L. Sp. Pl. 60. 1753; Thurb. in Wats. Bot. Cal. 2: 269. 1880; Davy in Jepson, Fl. W. Mid. Cal. 41. 1901; Abrams, Fl. Los Ang. 33. 1904.

20. **SPOROBOLUS** R. Br.

Spikelets 1-flowered, in narrow or open panicles. Glumes awnless, nearly or quite nerveless, usually unequal. Lemma equaling or exceeding the glumes, awnless. Palea equaling or exceeding the lemma. Grain readily falling from the spikelet, the pericarp loosely enclosing the seed, often thin and evanescent.

Annuals or perennials with small spikelets.—Species about 80, mostly American, from the warmer regions. (Greek spora, seed, and bolos, throwing.)

Plants annual; spikelets ½ line long.....1. *S. confusus.*
Plants perennial; spikelets 1 line long or more.
Plants densely cespitose, erect; without rhizomes.....2. *S. airoides.*
Plants not cespitose, decumbent-spreading; rhizomes present.....3. *S. asperifolius.*

1. **S. confusus** Vasey. Annual; culms slender, 6 to 8 inches high, often depauperate; blades mostly less than an inch long; panicles oblong, diffuse, often more than ½ the length of the entire plant, the branches capillary, spreading, 1 to 1½ inches long; spikelets ½ to ¾ line long, the glumes about ½ as long, equal, obtuse, sparsely pilose.

Open sandy or gravelly, usually moist ground, mostly near streams or lakes in the Sierra Nevada. Washington and Montana to Texas, Mexico and Lower California. Donner Lake, *Heller;* Mono Lake, *Bolander* 6096; Yosemite Valley, *Hitchcock* 3218.

Refs.—SPOROBOLUS CONFUSUS Vasey, Bull. Torr. Club 15: 293. 1888. *Vilfa confusa* Fourn. Mex. Pl. 2: 101. 1886. *Sporobolus ramulosus* [Kunth, misapplied by] Thurb. in Wats. Bot. Cal. 2: 269. 1880.

2. **S. airoides** Torr. Perennial; culms densely cespitose, forming large tussocks, smooth, stout, spreading at base, 1 to 3 feet high; sheaths smooth, sparsely pilose at the throat; blades involute, elongated, the upper short; panicles diffuse, finally about ½ the length of the entire plant; spikelets ¾ to 1 line long, obtuse; glumes unequal, the first oval, ½ as long as spikelet, the second as long as spikelet.

Bottomlands and valleys, often in saline or alkaline soil: Amador Co. (*Braunton* 1229) to Tia Juana (*Abrams* 3467), east in the Mohave (Newberry, *Hall* 6120) and Colorado (*Hall* 5885) deserts. Oregon to South Dakota, south into Mexico.

Refs.—SPOROBOLUS AIROIDES Torr. U. S. Rep. Expl. Miss. Pacif. 7: 21. 1856; Thurb. in Wats. Bot. Cal. 2: 269. 1880; Abrams, Fl. Los Ang. 34. 1904. *Agrostis airoides* Torr. Ann. Lyc. N. Y. 1: 151. 1824.

3. **S. asperifolius** Nees & Meyen. Perennial from creeping rhizomes; culms 1 to 2 feet long, ascending from a creeping or decumbent base; sheaths smooth, keeled; blades flat, 1 to 2 inches long, about 1 line wide, scabrous; panicles diffuse, tardily exserted from the uppermost sheath, oval, 4 to 6 inches long; spikelet ¾ line long, the glumes slightly unequal, a little shorter than the spikelet.

Meadows and wet places, especially in alkaline soil, from Lassen Co. (*Davy*) to Death Valley (*Coville & Funston* 246), Riverside (*Reed* 1950) and northern Ventura Co. (*Elmer* 3973). British Columbia to North Dakota, south to Texas and Mexico.

Refs.—SPOROBOLUS ASPERIFOLIUS Nees & Meyen, Acta Acad. Leop. Cur. 19: 141. 1843; Thurb. in Wats. Bot. Cal. 2: 269. 1880; Abrams, Fl. Los Ang. 34. 1904. *Vilfa asperifolius* Nees & Meyen; Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 95. 1840.

21. EPICAMPES Presl.

Spikelets 1-flowered, in elongated, narrow or spike-like panicles. Glumes 2, membranaceous. Lemma 3-nerved, of same texture as glumes and as long or longer, mucronate or short-awned. Palea about as long as lemma. Tall perennial bunch-grasses with pale many-flowered panicles and long narrow usually involute blades.—Species about 12, southern California to the Andes. (Greek epicampes, curved.)

1. **E. rigens** Benth. Culms erect, 3 to 4 feet high; sheaths smooth or slightly scabrous, covering the nodes; ligule truncate, ½ to 1 line long; blades scabrous, elongated, involute, tapering into a long slender point; panicle spike-like, slender, a foot long or more; glumes 1 to 1½ lines long, oblong, obtuse or somewhat erose, puberulent, convex, scarcely keeled, striate; lemma slightly exceeding the glumes, scaberulous, sparsely pilose at base, 3-nerved toward the narrowed summit, awnless.

Dry or open ground, hillsides, gullies and open forest: Butte Co. (Deep Creek Cañon, *Brewer* 1468) to Santa Barbara (*Elmer* 3743), San Diego (*Orcutt* 520) and San Jacinto Mts. (*Hall* 2427); east to New Mexico and south into Mexico.

Refs.—Epicampes rigens Benth. Jour. Linn. Soc. Bot. 19: 88. 1881; Abrams, Fl. Los Ang. 35. 1904. *Cinna macroura* [Kunth, misapplied by] Thurb. in Wats. Bot. Cal. 2: 276. 1880.

22. **POLYPOGON** Desf.

Spikelets 1-flowered, in dense terminal panicles. Glumes 2, ending in a long slender straight awn. Lemma much shorter than the glumes, hyaline, short-awned. Annual or perennial, spreading weedy grasses, with flat blades and bristly panicles.—Species about 10, mostly in the warmer regions of the Old World. (Greek polus, much, and pogon, beard.)

Awns ½ to 1½ lines long; panicle somewhat lobed.....1. *P. littoralis.*
Awns 3½ to 5 lines long; panicle compact.....2. *P. monspeliensis.*

1. **P. littoralis** Smith. Perennial; culms geniculate at base, 1 to 2½ feet high; sheaths scabrous; ligule 1 to 2 lines long or the uppermost longer; panicles oblong, 2 to 6 inches long, more or less interrupted or lobed; glumes equal, scabrous on back and keel, 1 to 1½ lines long, terminated by an awn as long; lemma smooth and shining, ½ line long, minutely toothed at the truncate apex; awn about as long as the glumes.

Introduced from Europe, from Vancouver Island to New Mexico. In California in waste places, especially along irrigating ditches at moderate altitudes, from Siskiyou Co. (*Butler* 481) to San Diego.

Refs.—Polypogon littoralis Smith, Comp. Fl. Brit. 13. 1800; Thurb. in Wats. Bot. Cal. 2: 270. 1880; Davy in Jepson, Fl. W. Mid. Cal. 42. 1901; Abrams, Fl. Los Ang. 36. 1904. *Agrostis littoralis* With. Arr. Brit. Pl. ed. 3. 2: 129. 1796.

2. **P. monspeliensis** Desf. Annual; culms erect or decumbent at base, scabrous below panicle, depauperate or as much as 3 feet long; sheaths smooth, the ligule large; panicles dense and spike-like, 1 to 6 inches long, ½ to 1 inch wide, tawny-yellow; glumes obtuse, hispidulous, 1 line long, terminating in an awn 3 to 4 lines long; lemma as in P. littoralis.

Introduced from Europe; common throughout California in waste places and along irrigating ditches at moderate altitudes; occasional in Atlantic States, common on Pacific Coast from Alaska to Mexico.

Refs.—Polypogon monspeliensis Desf. Fl. Atlant. 1: 67. 1798; Thurb. in Wats. Bot. Cal. 2: 270. 1880; Davy in Jepson, Fl. W. Mid. Cal. 42. 1901; Abrams, Fl. Los Ang. 35. 1904. *Agrostis monspeliensis* L. Sp. Pl. 61. 1753.

23. **CINNA** L.

Spikelets 1-flowered, articulated below the glumes, in rather loose panicles. Glumes 2, slightly unequal, acute. Lemma similar to the glumes, 3 to 5-nerved, mucronate from between the minute teeth of the bifid apex, raised on a short naked stipe, the rachilla prolonged behind the palea as a short smooth bristle. Palea apparently 1-nerved, the 2 nerves close together. Stamen 1.

Tall perennials with flat blades and nodding panicles.—Species 3, northern regions of Europe, Asia, and America. (Greek kinna, a name used by Dioscorides for a kind of grass.)

1. **C. latifolia** Griseb. Culms 2 to 4 feet high; blades 5 to 7 lines wide; panicle 6 to 12 inches long, the flexuous capillary branches spreading or drooping; glumes about equal, scabrous, 2 lines long; lemma about equaling the glumes, short-awned; palea 2-nerved, the nerves close together.

In moist places in woods and along streams, extending southward in the southern Sierra Nevada; also in cooler regions of North America and Eurasia.

Locs.—Mt. Tallac, *Hitchcock* 3130; Yosemite Nat. Park, *Bolander* 6090; Sequoia Nat. Park, Alta Meadow, *Hitchcock* 3370, Redwood Meadow, *Hitchcock* 3379.

Refs.—Cinna latifolia Griseb. in Ledeb. Fl. Ross. 4: 435. 1853. *Agrostis latifolia* Trev.; Goepp. Beschr. Bot. Gaert. in Breslau 82. 1830. *Cinna pendula* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4': 280. 1840. *C. arundinacea* L. var. *pendula* Gray, Man. ed. 2. 545. 1856; Thurb. in Wats. Bot. Cal. 2: 276. 1880. *C. bolanderi* Scribn. Proc. Acad. Phila. 1884: 290. 1884, type *Bolander* 6090.

24. AGROSTIS L.

Spikelets 1-flowered, in narrow or open panicles. Glumes subequal, acute or acuminate. Lemma shorter than the glumes, thin, obtuse, awnless or awned from the back. Palea small, minute, or wanting. Rachilla (except in sect. Podagrostis) not prolonged. Annual or usually perennial, slender grasses with small spikelets.—Species about 100, distributed over the entire world, especially in the north temperate zone. (An ancient Greek name of a forage grass, from agros, a field.)

Rachilla prolonged behind the palea (Section Podagrostis Griseb.).....1. *A. thurberiana.*
Rachilla not prolonged.
  Palea evident, 2-nerved.
    Palea about ¼ the length of lemma; panicle contracted.....4. *A. glomerata.*
    Palea as much as ½ the length of lemma; panicle open or contracted.
      Panicle contracted, lobed or verticillate; glumes scabrous on keel and back.....
        2. *A. stolonifera.*
      Panicle open or contracted, but not lobed; glumes scabrous on keel, smooth on back....
        3. *A. alba.*
  Palea wanting or a small nerveless scale.
    Lemma provided with a slender awn 2½ lines long; annual.....5. *A. exigua.*
    Lemma awnless or short-awned; perennials.
      Plants spreading by rhizomes (cf. A. lepida with short rhizomes).
        Tuft of hairs at base of lemma ½ to 1 line long.....6. *A. hallii.*
        Tuft of hairs minute or wanting.
          Panicle contracted .....7. *A. pallens.*
          Panicle open.....8. *A. foliosa.*
      Plants tufted, not producing rhizomes or only very short ones.
        Panicle narrow, usually a part of the lower branches spikelet-bearing from base.
          Panicle strict, branches short and appressed; plant low and cespitose.....
            9. *A. breviculmis.*
        Panicle narrow but not strict.
          Lemma with an exserted awn.
            Glumes awn-pointed; panicle narrow and rather compact...10. *A. microphylla.*
            Glumes acute but not awn-pointed; panicle more open and verticillate.....
              11. *A. ampla.*
          Lemma awnless or the awn included.
            Panicle 2 to 12 inches long; a taller plant of low altitudes...12. *A. exarata.*
            Panicle short, 1 to 2 inches long; a dwarf plant of high altitudes.....
              13. *A. rossae.*
        Panicle open, sometimes diffusely spreading; usually no short branches in lower whorls of branches.

Lemma awned; panicle purple; ligule 2½ to 4 lines long.....18. *A. longiligula.*
Lemma awnless; ligule usually short.
Panicle very diffuse; spikelets clustered toward end of branchlets.....
14. *A. hiemalis.*
Panicle open, but not conspicuously diffuse.
Plants producing short rhizomes.....17. *A. lepida.*
Plants not producing rhizomes.
Plants delicate, 4 to 12 inches high.....15. *A. idahoensis.*
Plants taller, over 1½ feet high.....16. *A. schiedeana.*

1. **A. thurberiana** Hitchc. Culms slender, erect, 8 to 15 inches high; panicle narrow, lax, more or less drooping, 2 to 3 inches long; spikelets green or pale, rarely purple, 1 line long; lemma nearly as long as glumes, the palea about ⅔ as long; rachilla prolonged behind the palea as a minutely hairy pedicel, ⅙ line long.

Bogs and moist places in the high Sierra Nevada, north and east to British Columbia and Montana.

Locs.—Siskiyou Co., *Butler* 1767; Pine Creek, Lassen Co., *Baker & Nutting;* Calaveras Co., *Hillebrand* 2251; Lake Chiquita, *Congdon;* Mariposa Co., *Bolander* 6102; Yosemite Nat. Park, *Hitchcock* 3269, 3338; Northfork, *Griffiths* 6652; Sequoia Nat. Park, *Hitchcock* 3366, 3407, 3473.

Refs.—Agrostis thurberiana Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 23. pl. 1. f. 1. 1905. *A. aequivalvis* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 271. 1880.

2. **A. stolonifera** L. Culms usually decumbent at base, sometimes with long creeping and rooting stolons; panicle contracted, lobed or verticillate, especially at base, 1½ to 4 inches long, light green or rarely purplish, the branches spikelet-bearing from the base; glumes equal, obtuse, scabrous on back and keel, 1 line long; lemma ½ line long, awnless, truncate and toothed at apex; palea nearly as long as the lemma.—Resembles in habit Polypogon littoralis, which differs in having awned glumes.

Moist ground, especially along irrigation ditches, at low altitudes from Mendocino Co. south, near the coast, and from Mariposa Co. and Inyo Co. south, especially abundant in the irrigated regions of the southern part of the state; southeast to Texas and Mexico. Introduced from Europe.

Refs.—Agrostis stolonifera L. Sp. Pl. 62. 1753. *A. verticillata* Vill. Prosp. 16. 1779; Thurb. in Wats. Bot. Cal. 2: 272. 1880; Davy in Jepson, Fl. W. Mid. Cal. 43. 1901; Abrams, Fl. Los Ang. 36. 1904.

3. **A. alba** L. Redtop. Culms erect or decumbent and rooting at base, 1 to 3 feet high, sending out from the base rhizomes or stolon-like stems; panicle loose but not diffuse, 2 inches to 1 foot long, the lower branches in whorls; glumes acute, 1 to 1½ lines long, scabrous on keel but not on back; lemma a little shorter than the glumes, obtuse, rarely awned on back; palea ½ to ⅔ as long as lemma.

Cultivated as a meadow grass and frequently escaped along roadsides and in waste places; apparently not native in California.

Var. **maritima** Meyer. Differs from A. alba in having decumbent rooting base and often widely spreading short-bladed stolons, and narrow contracted panicles.—Along the coast of Europe and North America; Pacific Coast from Sonoma Co. north to British Columbia. Upon the moist sand dunes the stolons are conspicuous.

Locs.—Crescent City, *Davy & Blasdale* 5944; Ft. Bragg, *Davy & Blasdale* 6124; Russ Ranch, *Davy & Blasdale* 6203; Guerneville, *Davy & Blasdale* 6003.

Refs.—Agrostis alba L. Sp. Pl. 63. 1753; Thurb. in Wats. Bot. Cal. 2: 271. 1880. Var. maritima Meyer, Chloris Hanov. 656. 1836. *A. maritima* Lam. Encycl. 1: 61. 1783. The

variety was referred to *A. depressa* Vasey, by Hitchcock, U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 28. 1905, and to *A. alba* L. var. *stolonifera* "Auct.", by Davy in Jepson, Fl. W. Mid. Cal. 43. 1901.

4. **A. glomerata** Kunth. Culms erect, 8 to 12 inches high, scabrous below panicle; sheaths conspicuously striate, often inflated; panicle close and spike-like, ½ to 3 inches long, the large forms more or less lobed; glumes 1½ lines long, sharp-pointed but usually not awned; lemma 1 line long, awnless or with a straight or bent awn from the middle of the back, the callus hairs short; palea ¼ line long, 2-nerved.

Along the coast from Mendocino Co. to Monterey; also Vancouver Island, Oregon and Peru.

Locs.—Mendocino, *Pringle;* Ft. Bragg, *Bolander* 6466, *Davy & Blasdale* 6167; Pt. Arena, *Davy & Blasdale* 6025; Pt. Reyes, *Davy* 6746, 6793; Pacific Grove, *Hitchcock* 2607.

Refs.—AGROSTIS GLOMERATA Kunth, Enum. Pl. 1: 219. 1833. *Vilfa glomerata* Presl, Rel. Haenk. 1: 239. 1830. *Agrostis californica* Trin. Mém. Acad. St. Pétersb. VI Sci. Nat. 4¹: 359. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata. A. mucronata* [Presl, misapplied by] Thurb. in Wats. Bot. Cal. 2: 272. 1880. *A. densiflora* Vasey, Contr. Nat. Herb. 3: 72. 1892, type from Santa Cruz, *Anderson;* Davy in Jepson, Fl. W. Mid. Cal. 43. 1901.

5. **A. exigua** Thurb. Annual; culms delicate, 1 to 4 inches high; panicle ½ the length of plant, finally open; glumes ¾ line long, scaberulous; lemma equaling the glumes, bearing below the tip a slender awn 4 times as long; palea wanting.

Only known from the type collection, "Foothills of the Sierras," *Bolander.*

Ref.—AGROSTIS EXIGUA Thurb. in Wats. Bot. Cal. 2: 275. 1880.

6. **A. hallii** Vasey. Culms erect, stout, 2 to 3 feet high, bearing rhizomes; ligule usually conspicuous; panicle 4 to 5 inches long, narrow, open; glumes about 2 lines long; lemma awnless, 1½ lines long, with a tuft of hairs at base about ½ as long; palea wanting.

Mostly in woods, near the coast from Santa Barbara (*Hitchcock* 2580) to Del Norte Co. (*Davy & Blasdale* 5918); north to Oregon.

Var. **pringlei** Hitchc. Differs from A. hallii in the narrower and more compact panicles, narrower and more involute blades and the more stramineous appearance of the whole foliage.—Near the coast, Mendocino Co.: Mendocino, *Congdon, Davy & Blasdale* 6075; Pt. Arena, *Davy & Blasdale* 6030.

Refs.—AGROSTIS HALLII Vasey, Contr. Nat. Herb. 3: 74. 1892. *A. davyi* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 3. 1901, type *Davy & Blasdale* 6062. Var. PRINGLEI Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 33. 1905. *A. pringlei* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 7: 156. 1897, type from Mendocino Co., *Pringle.*

7. **A. pallens** Trin. Culms 8 to 15 inches high, erect, from creeping rhizomes; panicle contracted, almost spike-like, 2 to 4 inches long; glumes 1¼ to 1½ lines long; lemma a little shorter than the glumes, awnless, the hairs at base minute; palea wanting.

Sandy soil near the coast, Marin Co. to Del Norte Co., north to Washington.

Locs.—Crescent City, *Davy & Blasdale;* Pt. Reyes, *Davy* 6682, 6839, 6880; Lands End, *Davy.*

Refs.—AGROSTIS PALLENS Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 328. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata.*

8. **A. foliosa** Vasey. Differs from A. pallens in the taller culms, and more open panicles, the branches rather stiffly ascending; lemma awnless (in most of the California specimens) or with a straight or rarely a bent awn.

Meadows and open woods, from Humboldt Co. south along the coast, in the Sierra Nevada to Mariposa Co., and in the San Jacinto Mts. Extends north to British Columbia.

Locs.—Eureka, *Davy & Blasdale* 6216; Siskiyou Co., *Butler* 1748; Castle Crag, *Hitchcock* 3066; Eagle Lake, *Davy;* Donner Lake, *Heller* 7076; Tahoe, *Hitchcock* 3079; Amador Co., *Hansen* 1818; Calaveras Co., *Hillebrand* 2248; Tuolumne River, *Bolander* 5064; Yosemite Valley, *Hitchcock* 3225; Pt. Reyes, *Davy* 6837; Angel Island, *Bolander* 1521; San Francisco, *Bolander* 1518, 2282; Black Mt., *Elmer* 4264; Pacific Grove, *Heller* 6848; Santa Lucia Mts., *Davy* 7702; San Jacinto Mts., *Hall* 2209; Santa Rosa Island, *Brandegee;* Santa Catalina Island, *Brandegee.*

Refs.—AGROSTIS FOLIOSA Vasey, Bull. Torr. Club 13: 55. 1886. *A. diegoensis* Vasey, Bull. Torr. Club 13: 55. 1886, type from San Diego, *Orcutt;* Davy in Jepson, Fl. W. Mid. Cal. 44. 1901; Abrams, Fl. Los Ang. 37. 1904. *A. scouleri* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 272. 1880. *A. pallens* Trin. var. *foliosa* Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 34. 1905

9. **A. breviculmis** Hitchc. Culms cespitose, erect, 4 to 6 inches high; panicle strict and narrow, about an inch long; glumes 1½ lines long, acute; lemma a little more than ½ as long as glumes, awnless or bearing a very short awn near the middle of the back; palea a minute nerveless scale.

On cliffs, Ft. Bragg, Mendocino Co., *Bolander* 6466 in part, *Davy & Blasdale* 6159. Also in Peru.

Refs.—AGROSTIS BREVICULMIS Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 36. 1905. *A. nana* Kunth, Enum. Pl. 1: 226. 1833, not Delarbre 1800.

10. **A. microphylla** Steud. Culms 1½ to 3 feet tall, or often depauperate; panicle narrow, close and spike-like, or rather loose, 4 to 12 inches long, the branches spikelet-bearing to the base; glumes 1½ lines long, more or less awn-pointed; lemma ⅓ shorter than glumes, bearing at the middle an exserted bent awn; palea wanting.

Open ground, prairies, dry hills and open woods, along the coast from Mendocino Co. to Monterey Co., and in the interior from Yosemite Nat. Park to Tulare Co.; also at San Diego (*Orcutt* 1173, 1176). British Columbia to Mexico.

Refs.—AGROSTIS MICROPHYLLA Steud. Syn. Pl. Glum. 1: 164. 1854; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata.*

11. **A. ampla** Hitchc. Culms 2 to 3 feet high; blades broad, 2½ to 4 lines wide; panicle large and spreading, 8 to 10 inches long, branches verticillate, the shorter ones spikelet-bearing from the base; glumes unequal, acuminate but not awn-pointed, the first 2 lines long; lemma 1¼ lines long, bearing a straight or bent awn at the middle; palea a minute, nerveless scale.

Moist ground, near the coast and in interior valleys; north to British Columbia and east to Arizona.

Locs.—Blairs, Mendocino Co., *Davy & Blasdale* 5262; Mendocino, *Brown* 799; Ft. Bragg, *Davy & Blasdale* 6118; Round Valley, *Chesnut* 94; Cloverdale, *Bolander* 6465; Auburn, *Shockley* 547, *Palmer* 2420 in 1892; Middle Fork Tule River, *Purpus* 5638; Colton, *Jones.*

Refs.—AGROSTIS AMPLA Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 38. pl. 20. 1905. *A. virescens* [H.B.K. misapplied by] Thurb. in Wats. Bot. Cal. 2: 274. 1880.

12. **A. exarata** Trin. Culms erect, 2 to 4 feet high, or often depauperate; panicle contracted and spike-like or loose and somewhat spreading, the branches densely flowered; glumes 1¼ to 1¾ lines long, scabrous on the keel and usually on the back; lemma 1 line long, awnless, or rarely with a short prickle on the back; palea a minute nerveless scale ⅛ line long.

Moist places, common throughout the state, especially near the coast and in the mountains up to 9000 feet; extends from Alaska to Mexico.

Refs.—AGROSTIS EXARATA Trin. Gram. Unifl. 207. 1824; Thurb. in Wats. Bot. Cal. 2: 273. 1880. *A. grandis* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 316. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata. A. asperifolia* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 317. 1840; Thurb. in Wats. Bot. Cal. 2: 273. 1880, under *A. exarata;* Davy in Jepson, Fl. W. Mid. Cal. 44. 1901; Abrams, Fl. Los Ang. 36. 1904.

13. **A. rossae** Vasey. Culms 4 to 8 inches high; panicle contracted, 1 to 2½ inches long, the branches appressed; spikelets green or purple, 1 line long; lemma ¾ line long, awnless; palea minute.—Differs from A. exarata chiefly in the size, possibly an alpine form of that species; glumes not scabrous on the back as usual in A. exarata.

Rocky creeks and mountain slopes; in California confined to the high Sierra Nevada; north to Washington and east to Wyoming.

Locs.—Donner Pass, *Heller* 7140; Rubicon River, *Leiberg* 5346; Summit Valley, *Pringle;* Mt. Tallac, *Hitchcock* 3150; Mt. Dana, *Bolander* 5070; Yosemite Nat. Park, *Hitchcock* 3331, *Lemmon;* Kern River, *Rothrock* 323.

Refs.—AGROSTIS ROSSAE Vasey, Contr. Nat. Herb. 3: 76. 1892. *A. varians* Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 314. 1840, not Thuill. 1790; Thurb. in Wats. Bot. Cal. 2: 273. 1880.

14. **A. hiemalis** B. S. P. Culms slender, tufted or scattered, 8 inches to 3 feet high, but usually delicate; leaves usually mostly basal, the blades narrow or almost setaceous; panicle very diffuse and open, as much as a foot long, the branches scabrous, long and capillary, bearing spikelets near the extremities; glumes ¾ to 1 line long, acute or acuminate; lemma ⅔ to ¾ as long as glumes; awnless or rarely awned; palea wanting.

Meadows and moist places in the Sierra Nevada and in the high mountains of southern California; extends throughout North America.

Var. **geminata** Hitchc. Differs from A. hiemalis in having a smaller, less diffuse panicle, with divaricate branches; culms usually less than a foot high; lemma awnless in the California specimens.—Arctic and alpine regions. Lassen Peak, *Jones;* Kern River, *Rothrock.*

Refs.—AGROSTIS HIEMALIS B.S.P. Prel. Cat. N. Y. 68. 1888. *Cornucopiae hiemalis* Walt. Fl. Carol. 73. 1788. *Agrostis scabra* Willd. Sp. Pl. 1: 370. 1798; Thurb. in Wats. Bot. Cal. 2: 274. 1880. Var. GEMINATA Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 44. 1905. *A. geminata* Trin. Gram. Unifl. 207. 1824.

15. **A. idahoensis** Nash. Culms slender, 4 to 12 inches high; panicle loosely spreading, 2 to 4 inches long, the branches capillary, minutely scabrous; spikelets ¾ line long; lemma 1 line long, awnless; palea minute.—Differs from A. hiemalis in the narrow panicle with shorter branches.

Mountain meadows of the Sierra Nevada, San Bernardino and San Jacinto mountains, north to Washington and east to Colorado.

Locs.—Lincoln Valley, Sierra Co., *Kennedy & Dotcn* 195; Amador Co., *Hansen* 2079; Calaveras Co., *Hillebrand* 2247; Clarks, *Torrey* 567; Yosemite Nat. Park, *Bolander* 6106, 6107, *Hitchcock* 3230, 3342; Mono Co., *Shockley* 614; Black Mt., *Hall & Chandler* 603; Northfork, *Griffiths* 6663; Kings River, *Brewer* 2823; Sequoia Nat. Park, *Hitchcock* 3463; San Bernardino Mts., *Hall* 7618, *Parish* 3302; San Jacinto Mts., *Hall* 2363, *Reed* 2500.

Refs.—AGROSTIS IDAHOENSIS Nash, Bull. Torr. Club 24: 42. 1897. *A. tenuis* Vasey, Bull. Torr. Club 10: 21. 1883, not Sibth. 1794.

16. **A. schiedeana** Trin. Culms 2 to 3 feet high; panicle oblong, 4 to 12 inches long, open, the branches verticillate, rather stiff and ascending, the lower whorls numerous, the longer 2 to 4 inches long, branching above the middle; glumes 1¼ to 1½ lines long; lemma ¾ line long, awnless; palea small, about ¼ line long.

Wet meadows, through the high Sierra Nevada, also in the San Bernardino Mts.; extends from British Columbia to Mexico.

Locs.—Big Meadows, Placer Co., *Austin* 1196; Tahoe, *Hitchcock* 3096; Glen Alpine, *McGregor* 33; Yosemite Valley, *Bolander* 4954, 6103; San Bernardino Mts., *Parish Bros.* 1560.

Refs.—AGROSTIS SCHIEDEANA Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 327. 1840.

A. elata [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 274. 1880. *A. hallii* Vasey var. *californica* Vasey, Contr. Nat. Herb. 3: 74. 1892, based on the preceding.

17. **A. lepida** Hitchc. n. sp. Culms tufted, 1 to 1½ feet high, erect, producing numerous short rhizomes; ligule long, especially on the innovations, these as much as 2 lines long, narrow, pointed; blades mostly basal, firm, erect, flat or folded, the upper culm leaf below the middle of the culm, the blade short, an inch long or less; panicle purple, erect, 4 to 6 inches long, the branches in verticils, stiff and straight, becoming divaricately spreading, the lowermost 1 to 2 inches long, spikelet-bearing from about the middle, some short branches intermixed; glumes 1½ lines long, smooth or nearly so; lemma 1 line long, awnless; palea wanting or a minute nerveless scale.—(Caespitosa, 1-1½ ped. alta, recta, rhizomatibus numerosis brevibus; folia firma, recta, omnia deorsum infra culmi mediam aggregata, ligula producta, laminis 1 poll. vel brevioribus; panicula purpurascens, 4-6 pol. longa, ramis verticillatis, rigidis, patentibus; glumae 1½ lin. longae, glabrae vel subglabrae; lemma 1 lin. longum, muticum; palea obsoleta.)

Type specimen collected in open gravelly woods, Siberian Pass, Sequoia National Park, California, by A. S. Hitchcock, Sept. 6, 1908 (no. 3455 in the National Herbarium). Other specimens referred to this species, all from Sequoia National Park, are: dry rocky soil, south of Farewell Gap, *Hitchcock* 3401; in mossy place, rim of Kern Cañon, near Bench Mark 9839, specimens in somewhat isolated bunches, *Hitchcock* 3434; dense masses in meadow, around lake, east of Kern Cañon, *Hitchcock* 3435. Differs from A. idahoensis in the larger spikelets, from A. hiemalis var. geminata in the firm blades, and from all of this group, in having rhizomes.

18. **A. longiligula** Hitchc. Culms erect, about 2 feet high; ligule 2½ to 3 lines long; paniele narrow, but loosely flowered, bronze-purple, 4 to 6 inches long, the branches very scabrous; glumes 2 lines long; lemma 1¼ lines long, bearing at the middle a bent exserted awn; palea minute.

Bogs and moist places, Mendocino Co. north to Alaska.

Locs.—Mendocino, *Davy & Blasdale* 6073, 6088, 6096; Ft. Bragg, *Davy & Blasdale* 6105, 6110, 6140; between Noyo and Albion, *Bolander* 6472.

Refs.—Agrostis longiligula Hitchc. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68: 54. pl. 36. f. 3. 1905, type *Davy & Blasdale* 6110. *A. canina* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 274. 1880.

25. **GASTRIDIUM** Beauv.

Spikelets 1-flowered, in spike-like panicles. Glumes 2, enlarged or saccate at base, much longer than the floret. Rachilla prolonged behind the palea. Lemma pubescent, truncate, hyaline, awnless or bearing an awn just below the apex. Palea narrow, about as long as the lemma. Cespitose annuals with flat blades and pale shining panicles.—Species 2, Mediterranean region. (Greek gaster, belly, referring to the saccate glumes.)

1. **G. lendigerum** Gaud. Culms about a foot high, smooth; panicle 2 to 3 inches long, dense and spike-like; glumes 1½ lines long, gradually narrowed into an awn-point; lemma much shorter than the glumes, globular, pubescent at apex, the awn 2½ lines long, geniculate.

Open ground and waste places, mostly in the Coast Ranges, at moderate altitudes. Also in Oregon and Texas. Introduced from Europe.

Refs.—Gastridium lendigerum Gaud. Fl. Helv. 1: 176. 1828; Davy in Jepson, Fl. W. Mid. Cal. 45. 1901; Abrams, Fl. Los Ang. 37. 1904. *Milium lendigerum* L. Sp. Pl. ed. 2. 91. 1762. *Gastridium australe* Beauv. Ess. Agrost. 164. 1812; Thurb. in Wats. Bot. Cal. 2: 275. 1880.

26. **CALAMAGROSTIS** Adans.

Spikelets 1-flowered, in narrow or open panicles. Glumes subequal, usually longer than the floret. Rachilla prolonged behind the palea as a usually hairy pedicel. Lemma with 2 pairs of lateral nerves, surrounded at the base with a tuft of hairs, awned from the back usually below the middle. Palea shorter than the lemma, faintly 2-nerved. Usually tall or reed-like perennials.—Species about 120, distributed throughout the world in temperate and arctic regions. (Greek calamos, a reed, and agrostis, a grass.)

Awn longer than the glume, and geniculate.
- Panicle open, the branches spreading.
  - Blades mostly basal, capillary ..... 1. *C. breweri.*
  - Blades scattered, broad and flat ..... 2. *C. bolanderi.*
- Panicle compact.
  - Glumes about 5 lines long, gradually long-acuminate ..... 3. *C. foliosa.*
  - Glumes 3 to 4 lines long, abruptly acute or acuminate ..... 4. *C. purpurascens.*

Awn shorter than the glumes, straight or somewhat geniculate.
- Panicle loose, the branches spreading or ascending.
  - Callus hairs copious, as long as lemma ..... 5. *C. canadensis.*
  - Callus hairs sparse, shorter than lemma.
    - Glumes 1½ to 2 lines long ..... 6. *C. californica.*
    - Glumes 2½ to 3 lines long ..... 7. *C. aleutica.*
- Panicle narrow, more or less spike-like.
  - Sheaths pubescent on collar ..... 8. *C. rubescens.*
  - Sheaths glabrous on collar.
    - Glumes ovate, firm or indurated, 2 lines long; awn straight ..... 9. *C. crassiglumis.*
    - Glumes lanceolate, thin.
      - Glumes 1½ lines long; awn straight ..... 10. *C. hyperborea.*
      - Glumes 2½ lines long; awn geniculate ..... 11. *C. densa.*

1. **C. breweri** Thurb. Culms slender, erect, cespitose, 6 to 12 inches high; leaves mostly basal, usually involute-filiform; panicle ovate, open, purple, 1 to 3 inches long, the lower branches slender, spreading, few-flowered, ½ to 1 inch long; glumes 1½ to 2 lines long, 1-nerved, smooth, acute; lemma nearly as long as glumes, cuspidate-toothed, the awn borne near the base, geniculate, exserted, twisted below, about 1 line long above the bend; rudiment long-pilose, 1 line long.

Mountain meadows of the high Sierra Nevada.

Locs.—Webber Lake, *Leiberg* 5259; Donner Pass, *Heller* 7130; Mt. Tallac, *Hitchcock* 3146; Yosemite Nat. Park, *Bolander* 6098, *Hall & Babcock* 3627, *Hitchcock* 3258, 3306, 3430, *Lemmon* in 1897; Sequoia Nat. Park, *Hitchcock* 3470, *Purpus* 5210.

Refs.—CALAMAGROSTIS BREWERI Thurb. in Wats. Bot. Cal. 2: 280. 1880, type from Carson Pass, *Brewer* 2128. *C. lemmoni* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 16. 1898, type collected in California by *Lemmon* in 1875.

2. **C. bolanderi** Thurb. Culms 3 to 4 feet tall; sheaths scabrous; blades flat, scattered, nearly smooth; panicle open, 4 to 8 inches long, the branches verticillate, spreading, naked below, the longer 2 to 4 inches long; glumes 1½ to 2 lines long, purple, scabrous, acute; lemma very scabrous, about as long as glumes, the awn from near base, geniculate, exserted, about 1 line long above the bend; rudiment pilose, 1 line long.

Bogs and moist ground, prairie or open woods, Mendocino and Humboldt cos. near the coast.

Locs.—Humboldt Co., *Kellogg & Harford* 1092; Mendocino, *Davy & Blasdale* 6074, 6090, *Pringle;* Pt. Arena, *Davy & Blasdale* 6128; Noyo River, *Bolander* 6471 in part, *Davy & Blasdale* 6574.

Refs.—CALAMAGROSTIS BOLANDERI Thurb. in Wats. Bot. Cal. 2: 280. 1880, type *Bolander* 6471 in part.

3. **C. foliosa** Kearn. Culms cespitose, erect, 1 to 2 feet high; leaves mostly basal, numerous, the blades involute, firm, smooth, nearly as long as culm; panicle dense, spike-like, 2 to 3 inches long; glumes 3 to 4 lines long, acuminate; lemma 2½ to 3½ lines long, acuminate, 4-nerved, the nerves ending in setaceous teeth; awn from near base, geniculate, about 4 lines long above the bend; rudiment pilose, nearly as long as lemma; callus hairs numerous, 1½ lines long.

Humboldt Co. (*Bolander* 6470, *Davy* 6602) and Mendocino Co. (*Congdon*), near the coast.

Refs.—CALAMAGROSTIS FOLIOSA Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 17. 1898, type *Bolander* 6470. *C. sylvatica* DC. var. *longifolia* Vasey, Contr. Nat. Herb. 3: 83. 1892 (not *C. longifolia* Hook.), type *Bolander* 6470. This is included under *C. sylvatica* by Thurber (in Wats. Bot. Cal. 2: 282. 1880).

4. **C. purpurascens** R. Br. Culms cespitose, erect, 1½ to 2 feet high; sheaths scabrous; blades flat or more or less involute, scabrous; panicle dense, spike-like, 2 to 5 inches long, pale or sometimes purple; glumes 3 to 4 lines long, scabrous; lemma nearly as long as glumes, 4-nerved, 4-awned at apex, the dorsal awn from near base, finally geniculate, exserted about 1 line.

In mountain meadows and on rocks, chiefly of the high Sierra Nevada; extends from arctic regions to California and Colorado. The Mt. Tamalpais specimens, differing in having pale panicles and larger spikelets, may be a distinct species.

Locs.—Mt. Dana, *Congdon;* Mt. Lyell, *Hitchcock* 3301; Mt. Tamalpais, *Chase* 5685, 5687, *Congdon, Heller* 8396, *Piper* 6315.

Refs.—CALAMAGROSTIS PURPURASCENS R. Br.; Richards, Bot. App. Frankl. Jour. 731. 1823; Davy in Jepson, Fl. W. Mid. Cal. 45. 1901. *C. sylvatica* [DC. misapplied by] Thurb. in Wats. Bot. Cal. 2: 282. 1880. Var. *purpurascens* Vasey, Contr. Nat. Herb. 3: 83. 1892, type from Mt. Dana, *Bolander* 5071.

5. **C. canadensis** Beauv. Culms 2 to 4 feet tall, from creeping rhizomes; blades scattered, flat, rather lax, scabrous, 2 to 4 lines wide; panicle narrow but loose, rather open, especially at base; glumes 2 lines long, smooth, scabrous on keel, acuminate; lemma nearly as long as glumes, smooth, narrowed toward summit; callus hairs abundant, about as long as the lemma; awn delicate, straight, attached just below the middle of the lemma and extending to or slightly beyond its tip; rudiment delicate, sparsely long-pilose.

Meadows and open woods in the high Sierra Nevada from Lake Tahoe to Mt. Whitney; extends throughout the northern part of North America.

Locs.—Mt. Tallac, *Hitchcock* 3129, *McGregor* 169; Hot Springs, *Austin* 1302; Silver Lake, *Davy;* Yosemite Nat. Park, *Hitchcock* 3252, 3282, *Lemmon;* Sequoia Nat. Park, *Hitchcock* 3372, 3429, 3445, 3465.

Refs.—CALAMAGROSTIS CANADENSIS Beauv. Ess. Agrost. 15. 1812; Thurb. in Wats. Bot. Cal. 2: 279. 1880. *Arundo canadensis* Michx. Fl. Bor. Am. 1: 173. 1803.

6. **C. californica** Kearn. Culms 3 feet tall; blades flat, firm, rather rigid, 2 lines wide, those of the innovations involute; panicle 8 inches long, narrow, loose; glumes 1½ to 2 lines long, scabrous, acuminate; lemma shorter than the glumes, strongly nerved; callus hairs abundant, ½ as long as the lemma; awn delicate, straight, attached below the middle, extending to tip of lemma.

A little-known species resembling C. canadensis but having more rigid firm blades, and callus hairs only ½ as long as lemma. The only specimens known are those of the type collection, from "Sierra Nevada Mts.," *Lemmon* 444 in 1875.

Ref.—CALAMAGROSTIS CALIFORNICA Kearn. U. S. Dept. Agr. Agrost. Bull. 11: 37. 1898.

7. **C. aleutica** Bong. Culms stout, 3 to 5 feet high; blades flat, becoming inrolled, elongated, gradually narrowed into a long involute point; panicle narrow, rather loose, 6 to 12 inches long, the branches rather stiffly ascending; glumes 2½ to 3 lines long, acuminate; lemma 2 lines long, indistinctly nerved, the callus hairs ½ as long; awn rather stout, attached below the middle, slightly geniculate, extending to summit of lemma.

Bogs and swamps, Monterey to Alaska, near the coast.

Loes.—Requa, *Davy & Blasdale* 5919; Mendocino, *Davy & Blasdale* 6089; Pt. Arena, *Davy & Blasdale* 6012, 6020, 6055; Ft. Bragg, *Davy & Blasdale* 6123, 6133, 6155; Noyo River, *Davy* 6576; Pt. Reyes, *Davy* 6702, 6785, 6817; San Francisco, *Bolander* 6084; San Pedro, *Elmer* 4693, 5033, 5040, 5051; Pacific Grove, *Davy* 7510, 7534, *Hitchcock* 2617.

Refs.—Calamagrostis aleutica Bong. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 2: 171. 1832; Thurb. in Wats. Bot. Cal. 2: 282. 1880; Davy in Jepson, Fl. W. Mid. Cal. 46. 1901. *C. subflexuosa* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 22. 1898, type from Oakland, *Bolander* 2274; Davy in Jepson, Fl. W. Mid. Cal. 46. 1901.

8. **C. rubescens** Buckl. Culms slender, 2 to 3 feet high, from creeping rhizomes; sheaths smooth, but pubescent on the collar; blades flat or somewhat involute; panicle narrow, spike-like, pale or purple, 3 to 6 inches long; glumes 2 to 2½ lines long, narrow, acuminate; lemma pale and thin, about as long as glumes, smooth, scarcely nerved, the callus hairs about ⅓ as long; awn attached near base, geniculate, exserted at side of glumes, the terminal portion about ½ line long.

Prairies and banks, Mendocino Co. (*Pringle* in 1882) to Santa Clara Co. (*Hitchcock* 2659) and Santa Cruz (*Anderson*); north and east to British Columbia and Manitoba.

Refs.—Calamagrostis rubescens Buckl. Proc. Acad. Phila. 1862: 92. 1863; Davy in Jepson, Fl. W. Mid. Cal. 47. 1901. *C. suksdorfii* Scribn. Contr. Nat. Herb. 3: 82. 1892. *C. aleutica* Bong. var. *angusta* Vasey, Contr. Nat. Herb. 3: 80. 1892, type from Santa Cruz, *Anderson*. *C. angusta* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 21. 1898, based on the preceding; Davy in Jepson, Fl. W. Mid. Cal. 46. 1901. *C. fasciculata* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 23. 1898, type from plains of Mendocino, *Pringle;* Davy in Jepson, Fl. W. Mid. Cal. 47. 1901.

9. **C. crassiglumis** Thurb. Culms rather stout, 6 inches to 1½ feet high; blades flat, or somewhat involute, smooth, firm, about 2 lines wide; panicle narrow, spike-like, 1 to 2 inches long; glumes 2 lines long, ovate, rather abruptly acuminate, purple, scaberulous, firm or almost indurated; lemma about as long as glumes, broad, obtuse; callus hairs abundant, about 1½ lines long; awn attached at middle of back, straight, about as long as lemma; rudiment ½ line long, the pilose hairs reaching to apex of lemma..

Swampy soil, from Mendocino Co., the type locality and only known station in the state, to Vancouver Island.

Ref.—Calamagrostis crassiglumis Thurb. in Wats. Bot. Cal. 2: 281. 1880, type *Bolander* 4766 (and 4787).

10. **C. hyperborea** Lange. Culms 1 to 2 feet high, producing stout rhizomes; sheaths smooth, the outer basal ones numerous, marcescent, persistent; blades loosely involute, scabrous, 1 to 2 lines wide; panicle narrow, more or less spike-like, 2 to 3 inches long; glumes 1½ lines long, scaberulous; lemma about as long as glumes, scabrous, the callus hairs ½ to ¾ as long; awn attached about the middle, straight, about as long as glumes; rudiment ¼ line long, some of the pilose hairs reaching to tip of lemma.

In mountain meadows of the high Sierra Nevada; extends from arctic North

America to northern U. S. The California specimens correspond best to var. stenodes Kearn.

Locs.—Susanville, *Jones;* Lyell Fork, *Hitchcock* 3291; Kaweah Meadows, *Purpus* 5128.

Refs.—Calamagrostis hyperborea Lange, Fl. Dan. 50: pl. 3. 1880. Var. *stenodes* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 39. 1898. *C. stricta* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 281. 1880.

11. **C. densa** Vasey. Culms 1½ to 2½ feet high, with creeping rhizomes; sheaths smooth or scabrous, no pubescence at collar or throat; blades flat or becoming somewhat involute, firm, scabrous, 1 to 2 lines wide; panicle narrow, dense, spike-like, more or less interrupted at base, 2 to 4 inches long, pale or purple; glumes about 2½ lines long, acuminate; lemma 1½ to 2 lines long, scaberulous; awn attached near base, geniculate, shorter than the glumes, the upper portion 1 line long, exserted at side of glumes; callus hairs 1 line long; rudiment about ¾ line long, the pilose hairs reaching to 1 or 1½ lines.

Prairies and banks, Oregon to California.

Locs.—Siskiyou Co., *Butler* 1746; headwaters of Sacramento, *Pringle* in 1881; Mendocino, *Congdon* in 1904; Mt. Tamalpais, *Blankinship* 28; Congress Springs, *Hitchcock* 2666; Julian, San Diego Co., *Orcutt* in 1889.

Refs.—Calamagrostis densa Vasey, Bot. Gaz. 16: 147. 1891, type from Julian, *Orcutt. C. vilfaeformis* Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 20. 1898, based on the preceding, the name changed because of *Deyeuxia densa* Benth. *C. koelerioides* Vasey, Bot. Gaz. 16: 147. 1891, type from Julian, *Orcutt. C. koelerioides* Vasey var. *densa* Beal, Grasses N. Am. 2: 345. 1896. Of C. densa, there is only the type collection, which is immature. It differs from *C. koelerioides* in being more robust (about 4 feet high) and in having a longer panicle. So far as can be determined from the immature specimen the spikelet characters are the same as those of *C. koelerioides.* The two forms are therefore provisionally united under the name C. densa which holds priority of position.

27. **AMMOPHILA** Host.

Spikelets 1-flowered in spike-like panicles. Glumes 2, firm, subequal, compressed-keeled, acute. Rachilla prolonged behind the palea as a hairy bristle. Lemma firm, about as long as glumes, surrounded at base with short hairs, 2-toothed at apex and mucronate between the teeth. Palea about as long as lemma, rather firm, the 2 nerves close together. A coarse perennial with creeping rhizomes, rigid culms and involute blades.—Species 1, on the sandy seacoast of Europe, the Atlantic Coast of North America, and the shores of the Great Lakes. (Greek ammos, sand, and philein, to love.)

1. **A. arenaria** Link. Beach-grass. Culms stout, 2 to 3 feet high; blades elongated, gradually narrowed into an involute point; panicle 4 to 12 inches long, dense; glumes as much as 5 lines long, scabrous.

Sands of the seacoast; introduced on the Pacific Coast where it has been used as a sandbinder. Pt. Arena, *Davy* 6046; Pt. Reyes, *Elmer* 5064; San Francisco, *Heller* 5670.

Refs.—Ammophila arenaria Link, Hort. Berol. 1: 105. 1827; Davy in Jepson, Fl. W. Mid. Cal. 47. 1901. *Arundo arenaria* L. Sp. Pl. 82. 1753.

28. **LAGURUS** L.

Spikelets 1-flowered, in dense capitate panicles. Glumes linear, long plumose-ciliate. Lemma narrow, smooth, 2-cleft, the divisions aristate, a dorsal awn arising from above the middle. Palea hyaline, 2-keeled. A low annual with flat blades and long-exserted, woolly panicles.—Species 1, southern Europe, sparingly introduced in California. (Greek lagos, hare, and oura, tail.)

1. **L. ovatus** L. Culms 4 to 12 inches high, slender, pubescent; leaves pubes-

cent; paniele about an inch long and nearly as thick; glumes very narrow, 5 lines long.

Berkeley, *Davy* 734; Pacific Grove, *Heller* 6701.

Ref.—Lagurus ovatus L. Sp. Pl. 81. 1753.

Tribe VI. AVENEAE.

29. **NOTHOLCUS** Nash, gen. nov.

Spikelets 2-flowered, articulated below the glumes, in contracted panicles, the lower floret perfect, awnless, the upper staminate, awned. Glumes thin, subequal, compressed, boat-shaped, longer than the florets. Lemmas somewhat indurated, boat-shaped. Palea thin, nearly as long as lemma. Perennials with flat blades and terminal panicles.—Species about 8, Europe and Africa. (Greek nothos, false, and Holcus, the generic name usually applied to this group.)—(Spiculae 2-florae, infra glumas articulatae. Flosculus inferior hermaphroditus, mutieus; superior masculus, aristatus. Glumae membranaceae, subaequales, compressae, naviculiformes, flosculis longiores. Lemmata duriuscula, naviculiformia. Palea membranacea, fere lemmate acquilonga.—Gramineae perennes, foliis planis et paniculis terminalibus.)

The name Holcus being applied to the genus Sorghum, with the type, *H. sorghum*, the above genus, Holcus of most recent authors, with the type *Holcus lanatus* L., must receive a new name. The section *Homalachna* Benth. & Hook. (Gen. Pl. 3: 1159. 1883), raised to the rank of a genus by Post & Kuntze (Lex. Gen. Phan. 285. 1903) includes two species of the Mediterranean region, in which both florets are perfect and awned, and is probably not congeneric with Notholcus. *Ginannia* Bub. (Fl. Pyr. 4: 321. 1901) is a homonym, according to Dalle Torre and Harms (Gen. Siphon.) the name having been used by Scopoli (Introd. 300. 1777) and by Dietrich (Vollst. Lex. Gaertn. 4: 357. 1804).

1. **N. lanatus** Nash, n. comb. Velvet-grass. Plant grayish, velvety-pubescent; culms erect, 1 to 2 feet high; panicle 2 to 4 inches long, narrow, contracted, sometimes almost spike-like, purple-tinged; spikelets 2 lines long; glumes villous, hirsute on the nerves, the second broader than the first, 3-nerved; lemmas ciliate at the apex; awn of the second floret hook-like.

A native of Europe, occasionally cultivated as a meadow grass in the U. S. and abundantly introduced or escaped on the Pacific Coast, especially in the Coast Ranges.

Refs.—Notholcus lanatus Nash, *Holcus lanatus* L. Sp. Pl. 1048. 1753; Thurb. in Wats. Bot. Cal. 2: 299. 1880; Davy in Jepson, Fl. W. Mid. Cal. 49. 1901; Abrams, Fl. Los Ang. 38. 1904.

30. **AIRA** L.

Spikelets 2-flowered, both flowers perfect, articulated below the glumes, in open or contracted panicles. Glumes thin, somewhat scarious, subequal, acute, awnless, longer than the approximate florets. Lemmas bidentate, awned on the back, or the lower awnless. Palea a little shorter than the lemma. Delicate annuals.—Species about 6, Europe and North Africa, introduced in the U. S. (An ancient Greek name used by Theophrastus for a weedy grass, probably Lolium temulentum.)

Awns of both florets 1½ to 2 lines long.....1. *A. caryophyllea.*
Awn of lower floret minute or wanting.....2. *A. capillaris.*

1. **A. caryophyllea** L. Culms solitary or few, slender, erect, 4 to 12 inches high; blades short, setaceous; panicle open, the silvery shining spikelets 1½ lines long, clustered toward the ends of the spreading capillary branches; lemma of both florets with a geniculate awn 2 lines long from below the middle, the teeth of the apex setaceous.

Introduced from Europe, common in open ground from Vancouver Island to southern California.

Refs.—AIRA CARYOPHYLLEA L. Sp. Pl. 66. 1753; Davy in Jepson, Fl. W. Mid. Cal. 49. 1901.

2. **A. capillaris** Host. Similar to A. caryophyllea; panicle more diffuse; spikelets scattered at the ends of the branches, 1¼ lines long; lemma of lower floret awnless or with a minute awn just below the apex, the teeth short; lemma of upper floret bearing a geniculate awn 1½ lines long from below the middle, the teeth setaceous.

Sparingly introduced from Europe. Redwood Creek, Humboldt Co., *Davy & Blasdale* 5684; Kenwood, *Michener* 121.

Refs.—AIRA CAPILLARIS Host, Gram. Austr. 4: 20, pl. 35, 1809; Davy in Jepson, Fl. W. Mid. Cal. 50. 1901.

31. **DESCHAMPSIA** Beauv.

Spikelets 2 (rarely 3)-flowered, in narrow or open panicles. Glumes subequal, thin or scarious. Rachilla prolonged behind the upper floret as a hairy bristle. Lemmas 4-nerved (the midnerve becoming an awn), truncate, 2 to 4-toothed, bearing a slender dorsal awn from below the middle. Annuals or perennials, with shining spikelets.—Species about 20, in the cold and temperate regions of the world. (Loiseleur-Deslongchamps, a French botanist, 1774—1849.)

Plants annual; awns strongly geniculate.
  Glumes 3½ to 4 lines long ..... 1. *D. danthonioides.*
  Glumes about 2 lines long ..... 2. *D. gracilis.*
Plants perennial; awns straight.
  Panicle dense; plant stout ..... 5. *D. holciformis.*
  Panicle loose or open.
    Plants robust; blades flat, 1 line wide or more; branches of panicle spreading ..... 4. *D. caespitosa.*
    Plants slender; blades capillary; branches of panicle erect ..... 3. *D. elongata.*

1. **D. danthonioides** Munro. Annual; culms slender, erect, 6 to 15 inches high; blades few, short and narrow; panicle open, 3 to 6 inches long, the branches capillary, stiffly ascending, naked below, bearing a few spikelets toward the ends; glumes 3 to 4 lines long, acuminate, smooth except the keel, longer than the florets; lemmas smooth and shining, somewhat indurated, 1 to 1½ lines long, the base of the florets and the rachilla pilose, the awns geniculate, 2 to 3 lines long.

Open ground throughout California except in the higher mountains; extends from Alaska to Mexico.

Refs.—DESCHAMPSIA DANTHONIOIDES Munro; Benth. Pl. Hartw. 342. 1857. *Aira danthonioides* Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 57. 1830 (Jan., apparently earlier than Presl's work); Thurb. in Wats. Bot. Cal. 2: 298. 1880. *Danthonia calycina* Presl, Rel. Haenk. 1: 251. 1830, type from Monterey; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901; Abrams, Fl. Los Ang. 39. 1904.

2. **D. gracilis** Vasey. Annual; culms 1 to 2 feet high; blades usually filiform; panicle open, 3 to 8 inches long, the branches slender, rather densely flowered toward the ends, naked below; glumes 2 to 3 lines long, the first 3-nerved; lemmas as in D. danthonioides.

Damp places; Mendocino Co. southward to Lower California. Sherwood, *Hitchcock* 2709; Tulare, *Davy* 3086, 3088, 3114; San Gabriel, *Hasse*; San Diego, *Brandegee* 3681, *Pringle* in 1882.

Refs.—DESCHAMPSIA GRACILIS Vasey, Bot. Gaz. 10: 224. 1885, type from San Diego, *Orcutt.*

3. **D. elongata** Munro. Perennial; culms slender, erect, 1 to 4 feet high;

blades flat, narrow, the basal cluster usually capillary; panicle narrow, as much as a foot long, the branches slender, appressed; glumes 2 to 3 lines long; lemmas 1 line long, similar to those of D. danthonioides, the awns shorter.

Open ground, common in the Coast Ranges south to Santa Cruz and in the lower Sierra Nevada, occasional in southern California; extends from Alaska to Arizona.

Refs.—DESCHAMPSIA ELONGATA Munro; Benth. Pl. Hartw. 342. 1857; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901. *Aira elongata* Hook. Fl. Bor. Am. 2: 243, pl. 288. 1840. *Deschampsia elongata* Munro var. *ciliata* Vasey; Beal, Grasses N. Am. 2: 371. 1896; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901. Var. *tenuis* Vasey; Davy in Jepson, Fl. W. Mid. Cal. 51. 1901, type from Santa Clara Co., *Davy* 213.

4. **D. caespitosa** Beauv. Perennial; culms erect, 2 to 4 feet high; sheaths smooth; blades flat or folded, scabrous above; panicle loose, drooping, 4 to 8 inches long, the slender scabrous branches spikelet-bearing toward the ends; spikelet 2 lines long, the florets distant, the rachilla ½ the length of the lower sessile floret; lemmas smooth, erose-truncate; awn from near the base, but little longer than the lemma, straight, articulated at the base, deciduous.

Common in mountain meadows and bogs in the Sierra Nevada and in the high mountains of southern California. The only specimens seen from the Coast Ranges are: Sherwood, *Davy & Blasdale* 5180, 5181. Northern regions of the northern hemisphere and southward in the mountains to Mexico.

Refs.—DESCHAMPSIA CAESPITOSA Beauv. Ess. Agrost. 91. pl. 18. f. 3. 1812. *Aira caespitosa* L. Sp. Pl. 64. 1753; Thurb. in Wats. Bot. Cal. 2: 297. 1880. *Deschampsia caespitosa* Beauv. var. *confinis* Vasey; Beal, Grasses N. Am. 2: 369. 1896, type from California, *Palmer* 231.

5. **D. holciformis** Presl. Perennial; culms cespitose, 2 to 4 feet high, rather stout; blades tightly folded, or involute, firm, mostly basal, smooth or somewhat scabrous especially toward the tip, the cauline blades short; ligule 2 to 3 lines long; panicle narrow, rather dense, mostly dark or bronze-color, 6 to 8 inches long.

Marshes, bogs, and moist places near the coast, from Del Norte Co. to Monterey Co.

Locs.—Smith River, *Davy & Blasdale* 6194; Eureka, *Davy & Blasdale* 6213, 6214; Pt. Arena, *Davy & Blasdale* 6043; Pt. Reyes, *Davy* 6683; Petaluma, *Piper* 6318; San Francisco, *Bolander* 6071; Oakland, *Bolander* 1524; Santa Cruz, *Anderson*; Pacific Grove, *Davy* 7508.

Refs.—DESCHAMPSIA HOLCIFORMIS Presl, Rel. Haenk. 1: 251. 1830; Davy in Jepson, Fl. W. Mid. Cal. 50. 1901. *Aira holciformis* Steud. Syn. Pl. Glum. 1: 221. 1854; Thurb. in Wats. Bot. Cal. 2: 297. 1880.

32. **TRISETUM** Pers.

Spikelets 2 (rarely 3 to 5)-flowered, in narrow or open panicles. Glumes unequal, the second about as long as the florets, keeled, the first 1-nerved, the second 3-nerved. Rachilla prolonged behind the upper floret as a hairy bristle or pedicel. Lemmas membranaceous, keeled, 2-toothed at the apex (teeth often aristate), bearing a slender dorsal awn. Palea narrow, 2-toothed. Tufted perennials.—Species about 50, arctic and temperate regions and the high mountains of the tropics. (Latin tres, three, and seta, bristle, the lemma often being 2-awned from the apex, and 1-awned from the back.)

Awn included or wanting ..... 1. *T. brandegei.*
Awn exserted.
Panicle loose and open, the branches naked at base ..... 2. *T. cernuum.*

Panicle narrow or compact.
Panicle narrow but loose; blades flat, usually 2½ to 5 lines wide.....3. *T. canescens.*
Panicle spike-like.
Sheaths pubescent .....4. *T. spicatum.*
Sheaths glabrous .....5. *T. congdoni.*

1. **T. brandegei** Scribn. Culms smooth, erect, 1 to 2 feet high; sheaths smooth or sparsely retrose-pilose; blades flat, erect, 1 to 2 lines wide, scabrous or more or less pilose; panicle narrow, usually spike-like, 2 to 4 inches long; glumes about 3 lines long, scabrous on the keel, subequal, the first 1-nerved or obscurely 3-nerved, the second 3-nerved; lemmas scaberulous, the lower 2 lines long, the awn reduced to a bristle scarcely reaching the tip, or on the upper lemma obsolete, the teeth acute, not aristate.

Mountain meadows in the Sierra Nevada; also in the Cascades of Oregon (the type).

Loes.—Mt. Tallac, *Hitchcock* 3147, 3148; Shadow Lake Trail, *Congdon* in 1899; Long Meadow, Tuolumne Co., *Hitchcock* 3261; Kings River, *Brewer* 2822a.

Refs.—TRISETUM BRANDEGEI Scribn. Bull. Torr. Club 10: 64. 1883. *T. subspicatum* Beauv. var. *muticum* Boland.; Thurb. in Wats. Bot. Cal. 2: 296. 1880, type from the upper Tuolumne, *Bolander* 5019. *T. muticum* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 50. 1898.

2. **T. cernuum** Trin. Culms rather lax, 2 to 4 feet high; sheaths smooth; blades thin, flat, lax, scabrous, 3 to 6 lines wide; panicle open, lax or drooping, 6 to 12 inches long, the branches verticillate, slender, flexuous, spikelet-bearing toward the ends; spikelet ¼ to ½ inch long, with usually 3 distant florets, the first longer than the second glume; glumes very unequal, the first narrow, acuminate, 1-nerved, ½ line long, the second broad, 3-nerved, 1½ to 2 lines long; lemmas with setaceous teeth, the awns about as in T. canescens.

Moist woods, Alaska to Montana and northern California: Humboldt Bay, *Chandler* 1176; Mendocino Co., *Bolander* 4758, 6122, *Brown* 764.

Refs.—TRISETUM CERNUUM Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 61. (Jan.) 1830; Thurb. in Wats. Bot. Cal. 2: 295. 1880; Davy in Jepson, Fl. W. Mid. Cal. 52. 1901. *Avena nutkaensis* Presl, Rel. Haenk. 1: 254. 1830. *Trisetum nutkaense* Scribn. & Merr.; Davy, Univ. Cal. Publ. Bot. 63. 1902; Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 55. 1911.

3. **T. canescens** Buckl. Culms erect, or decumbent at base, 2 to 4 feet high; sheaths more or less retrose-pilose, at least the lower, and often also canescent; blades flat, scabrous or canescent; panicle narrow, loose, sometimes interrupted and spike-like, 4 to 8 inches long; glumes smooth, except the keel, strongly unequal, the first narrow, acuminate, 1-nerved, the second broad, acute, 3-nerved, longer than the first, 2½ to 3½ lines long; lemmas firm, scaberulous, the upper exceeding the glumes, the teeth aristate; awns geniculate, spreading, exserted, more or less twisted below, attached ⅓ below the apex, usually about ½ inch long.

Mountain meadows, moist ravines, and along streams; Coast Ranges south to Santa Cruz, and Sierra Nevada south to Tulare Co.; north to Vancouver Island, east to Montana and New Mexico. Two specimens have a more condensed panicle than usual (Mt. Tamalpais, *Davy* 139; Mendocino Co., *Bolander* 4744).

Refs.—TRISETUM CANESCENS Buckl. Proc. Acad. Phila. 1862: 100. 1863; Thurb. in Wats. Bot. Cal. 2: 296. 1880; Davy in Jepson, Fl. W. Mid. Cal. 52. 1901.

T. CHROMOSTACHYUM Desv. from Chile is a closely allied species with acuminate awned glumes and shorter pedicels.

4. **T. spicatum** Richter. Culms erect, rather stout, 6 to 18 inches high,

smooth or puberulent; sheaths and usually the blades puberulent; panicle dense and spike-like, pale or often dark-purple, 2 to 6 inches long; spikelets 2 to 3 lines long; glumes somewhat unequal in length, smooth except the keels, the first narrow, acuminate, 1-nerved, the second broader, 3-nerved, acute; lemmas scaberulous, 2½ lines long, the first longer than the glumes, the teeth setaceous; awns geniculate, exserted.

A characteristic grass of high altitudes in the Sierra Nevada, especially above timber-line, found up to the limit of vegetation; extends from arctic regions of the northern hemisphere southward in the higher mountains to the southern hemisphere.

Refs.—TRISETUM SPICATUM Richter, Pl. Eur. 1: 59. 1890. *Aira spicata* L. Sp. Pl. 64. 1753. *Trisetum subspicatum* Beauv. Ess. Agrost. 88. 1812; Thurb. in Wats. Bot. Cal. 2: 296. 1880. *Aira subspicata* L. Syst. Veg. ed. 10. 2: 873. 1759. *Trisetum subspicatum* Beauv. var. *molle* Gray, Man. ed. 2. 572. 1856; Thurb. in Wats. Bot. Cal. 2: 296. 1880.

5. **T. congdoni** Scribn. & Merr. Resembling T. spicatum, but differing in having smooth sheaths and blades, the latter usually flat but sometimes involute, and in having wider panicles and larger spikelets, about 4 lines long.

Meadows and slopes above timber-line, Sierra Nevada.

Locs.—Mt. Shasta, *Copeland* 3895, *Hitchcock* 2935; Donner Pass, *Heller* 7117; Lake Tahoe, *Hall & Chandler* 4676; Pyramid Peak, *Hall & Chandler* 4715; Yosemite Nat. Park, *Hitchcock* 3260, 3270, 3271, 3312; Sequoia Nat. Park, *Coville & Funston* 1495, *Grant* 5339, *Hall & Babcock* 5512, 5678, *Hitchcock* 3390, *Purpus* 5116.

Ref.—TRISETUM CONGDONI Scribn. & Merr. Bull. Torr. Club 29: 470. 1902, type from Shadow Lake Trail, *Congdon* in 1899.

33. **SPHENOPHOLIS** Scribn.

Spikelets 2 to 3-flowered, articulated below the glumes, in narrow panicles. Glumes about equal in length, often dissimilar in shape, the first narrow, the second often obovate, becoming subcoriaceous in fruit, 3-nerved. Rachilla prolonged behind the uppermost floret as a slender pedicel. Lemma chartaceous, awnless or awned below the summit, the nerves obscure. Slender perennials.—Species about 6, all North American. (Greek sphen, a wedge, and pholis, a scale.)

1. **S. obtusata** Scribn. var. **lobata** Scribn. Culms erect, 1 to 2 feet high; sheaths and blades scabrous; panicle narrow and compact, often spike-like, more or less interrupted or lobed especially near base, 2 to 4 inches long; glumes subequal, the second subcucullate, the broad chartaceous margins smooth and shining.

Prairies and open woods throughout U. S. and extending into Canada and Mexico. Rare in California.

Locs.—Amador Co., *Hansen* 615; Santa Ana River, *Parish Bros.* 1640; San Bernardino, *Parish* in 1891; Murray Cañon, *Wilder* 1128.

Refs.—SPHENOPHOLIS OBTUSATA Scribn. var. LOBATA Scribn. Rhodora 8: 144. 1906. *Trisetum lobatum* Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1: 66. 1830. *Eatonia obtusata* Gray, Man. ed. 2. 558. 1856; Thurb. in Wats. Bot. Cal. 2: 302. 1880. *Eatonia* Raf. is a synonym of Panicum.

34. **KOELERIA** Pers.

Spikelets 2 to 4-flowered, in narrow spike-like panicles. Glumes unequal, slightly shorter than the florets, membranaceous, acute, the first 1-nerved, the second 3-nerved. Rachilla prolonged behind the uppermost floret as a naked pedicel. Lemmas chartaceous-membranaceous, the margins scarious, faintly 3 to 5-nerved, acute or mucronate or awned. Tufted annuals or perennials.—Species about 50, temperate regions, mostly of the Old World. (Prof. G. L. Koeler, an early writer on grasses.)

Plants annual; culm glabrous below panicle.....1. *K. phleoides.*
Plants perennial; culm puberulent below panicle.....2. *K. cristata.*

1. **K. phleoides** Pers. Annual; culms 6 to 12 inches high, smooth throughout; paniele close and spike-like, 1 to 3 inches long, obtuse; spikelets 1 to 2 lines long; glumes smooth, acute, the first narrower; lemmas smooth, short-awned from a bifid apex.

Introduced from Europe. Lassen Peak, *Austin* in 1882; Butte Co., *Heller* 5534; Lathrop, *Congdon* in 1896.

Refs.—KOELERIA PHLEOIDES Pers. Syn. Pl. 1: 97. 1805. *Festuca phleoides* Vill. Fl. Delph. 2: 95. 1787.

2. **K. cristata** Pers. Perennial; culms erect, 1 to 2 feet high, glabrous below, puberulent below panicle; sheaths pubescent, at least the lower; blades mostly basal, rather short; panicle compact, spike-like, pointed, 2 to 4 inches long, often interrupted at base; spikelets 2 to 2½ lines long; glumes and lemmas scabrous.

Prairies and open woods, mostly in the Coast Ranges and in the southern mountains; extends throughout the cooler parts of the northern hemisphere.

Var. **longifolia** Vasey. Differs in being taller, and in having longer blades, the basal as much as a foot long, and larger and looser panicles.—Open woods in the Coast Ranges.

Refs.—KOELERIA CRISTATA Pers. Syn. Pl. 1: 97. 1805; Thurb. in Wats. Bot. Cal. 2: 301. 1880; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901; Abrams, Fl. Los Ang. 45. 1904. *Aira cristata* L. Sp. Pl. 63. 1753. *Koeleria cristata* Pers. var. *pubescens* Vasey; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901. Var. *pinetorum* Abrams, Fl. Los Ang. 46. 1904. Var. LONGIFOLIA Vasey; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901, type from Santa Cruz, *Anderson,*

In a recent monograph of the genus Koeleria by Domin (Bibl. Bot. Heft. 65. 1907), the California specimens are referred as follows: *K. gracilis* Pers., *Bolander* 1531, *Hall* 1342. *K. gracilis* var. *glabra* Domin subvar. *genuina* Domin, San Diego, *Vasey. K. gracilis* var. *genuina* subvar. *superfusa* Domin, *Heller* 6814. *K. pseudocristata* Domin forma *densevestita* Domin, *Hall* 2206. *K. pseudocristata* forma *lara* Domin, *Heller* 7443. *K. polyantha* Domin var. *californiensis* Domin, *Hall* 2131. *K. nitida* Nutt. var. *typica* Domin forma *glabra* Domin, San Diego, *Orcutt* in 1884, S. E. Calif. *Palmer* in 1876. *K. nitida* var. *typica* forma *pubescens* Domin, Thomas Meadows, *Hall* in 1901. *K. nitida* var. *californica* Domin, San Diego, *Pringle* in 1882. *K. nitida* var. *californica* subvar. *transiens* Domin, San Diego, *Brandegee* in 1903, *Baker* 3678. *K. nitida* var. *californica* subvar. *multiflora* Domin, San Bernardino Mts., *Parish Bros.* 855. *K. nitida* var. *californica* subvar. *vestita* Domin, "Cusamacca Mts.," *Palmer* in 1875.

35. AVENA L.

Spikelets 2 to 6-flowered, in open panicles. Rachilla bearded below the florets. Glumes subequal, membranaceous, many-nerved, longer than the lemmas and usually exceeding the uppermost floret. Lemmas indurated except toward the summit, 5 to 9-nerved, bidentate at apex, bearing a long dorsal twisted awn (often straight or wanting in cultivated forms). Annuals or perennials with large spikelets.—Species about 50 in the temperate and cooler regions of the world, the California species all annuals, introduced from Europe. (The classical Latin name.)

Lemmas glabrous or nearly so.
Spikelets usually 2-flowered; awn usually wanting, or if present weakly geniculate.....2. *A. sativa.*
Spikelets usually 3-flowered; awn present, strongly geniculate....1. *A. fatua* var. *glabrata.*
Lemmas pubescent with long, usually brown hairs.
Teeth of lemmas acute not awned.....1. *A. fatua.*
Teeth of lemmas awned.....3. *A. barbata.*

1. **A. fatua** L. WILD OAT. Culms 1 to 3 feet high, erect, stout; panicle loose and open, the slender branches usually horizontally spreading; spikelets usually 3-flowered; glumes about 1 inch long; rachilla and lower part of the shining lemma clothed with long stiff brownish hairs; florets readily falling from the glumes; lemma nerved above, about 10 lines long, the teeth acuminate but not awned; awn stout, geniculate, red-brown, twisted below, about 1½ inches long.

A native of Europe, a common weed on the Pacific Coast. Fields and waste places, especially in southern California.

Var. **glabrata** Peterm. Differs in having nearly or quite glabrous lemmas.—Introduced from Europe, in similar situations with the species.

Refs.—AVENA FATUA L. Sp. Pl. 80. 1753; Thurb. in Wats. Bot. Cal. 2: 295. 1880; Davy in Jepson, Fl. W. Mid. Cal. 53. 1901; Abrams, Fl. Los Ang. 39. 1904. Var. GLABRATA Peterm. Fl. Bein. 13. 1841. Var. *glabrescens* Coss. Fl. Alg. 113. 1867; Davy in Jepson, Fl. W. Mid. Cal. 53. 1901; Abrams, Fl. Los Ang. 40. 1904.

2. **A. sativa** L. CULTIVATED OAT. Similar to A. fatua; florets not readily separating from the glumes; spikelets usually 2-flowered; lemma glabrous; awn straight, often wanting.

Commonly cultivated and occasionally escaped.

Refs.—AVENA SATIVA L. Sp. Pl. 79. 1753; Davy in Jepson, Fl. W. Mid. Cal. 54. 1901.

3. **A. barbata** Brot. Similar to A. fatua; spikelets somewhat smaller, mostly 2-flowered, the pedicels curved and capillary; lemma clothed with stiff red hairs, the teeth acuminate and ending in fine awns 2 lines long.

A native of Europe, introduced on the Pacific Coast; a common weed in fields and waste places.

Refs.—AVENA BARBATA Brot. Fl. Lusit. 1: 108. 1804; Davy in Jepson, Fl. W. Mid. Cal. 54. 1901.

ARRHENATHERUM ELATIUS Beauv. Tall Oat Grass. This has been collected at Agricultural Station, Amador Co., by Hansen (no. 1737) and in the Berkeley Hills by Davy. It is a native of Europe, often cultivated in the Eastern States as a meadow grass and frequently escaped along roadsides and into waste places. As yet it appears to be rare in California. It can be recognized by the 2-flowered spikelet, the upper perfect and awnless or nearly so, and the lower staminate and dorsally awned. A tall perennial with flat blades and long narrow panicles. (See also Davy in Jepson, Fl. W. Mid. Cal. 54. 1901.)

36. **DANTHONIA** DC.

Spikelets several-flowered, in narrow or open panicles, the uppermost floret reduced. Glumes 2, subequal, much longer than the lemmas and usually exceeding the uppermost floret. Lemmas convex, 2-toothed at apex, with a twisted awn from between the teeth, the awn flat, formed by the extension of the 3 middle nerves of the lemma. Tufted perennials with numerous basal innovations and few-flowered simple panicles.—Species about 100 in the temperate and warmer region of both hemispheres, only about 8 in North America. (Étienne Danthoine, a French botanist.)

Sheaths pubescent.
- Spikelets 2 to 4 ..... 1. *D. americana.*
- Spikelets solitary ..... 2. *D. unispicata.*

Sheaths glabrous.
- Spikelets on spreading pedicels ..... 3. *D. californica.*
- Spikelets on short erect pedicels, forming a narrow spike-like panicle ..... 4. *D. intermedia.*

1. **D. americana** Scribn. Culms 1 to 2 feet high, smooth, tending to disarticulate at the nodes; sheaths pilose; blades short, flat, or those of the innovations involute; panicle bearing 2 to 5 spikelets, the pedicels usually about ½ inch long, spreading or somewhat reflexed; glumes ½ to ¾ inch long, smooth, acuminate, about 7-nerved; lemmas 2½ to 3½ lines long, smooth and convex on the back, pilose at base and margins, broad, abruptly contracted into 2 teeth with awns 1 to 3 lines long, the dorsal awn from between these teeth, geniculate, flat and twisted below, straight and divergent above, exserted.

Wet meadows and moist places in rocks, British Columbia to Wyoming, south to the San Bernardino Mts. Also in Chile.

Locs.—Siskiyou Co., *Butler* 1660; Humboldt Co., *Chandler* 1239; Mt. Tallac, *Hitchcock* 3158; Lake Tahoe, *Reed & Pendleton* 1776; San Francisco, *Davy* 4211; Crystal Springs Lake, *Elmer* 4707; Monterey, *Davy* 7237 in part, 7260; Kaweah Meadows, *Purpus* 5247; San Bernardino Mts., *Davidson* 2319, *Parish* 3295.

Refs.—DANTHONIA AMERICANA Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 5. 1901, based on *D. grandiflora* Phil. (1873) from Chile, not Hochst. (1851). *Merathrepta americana* Piper, Contr. Nat. Herb. 11: 123. 1906. Piper assumes that the type species of Danthonia DC. is *D. decumbens*, which is not congeneric with *D. spicata* and its allies. I believe, however, that *D. spicata* should be taken as the type of Danthonia, in which case the latter name is retained for the California species.

2. **D. unispicata** Munro. Culms short, 6 to 8 inches high, about as long as the numerous basal leaves; sheaths and blades pilose; panicle reduced to a single spikelet, the pedicel about ½ inch long, flexuous, pubescent above, the joint at base bearing 1 or 2 bracts; spikelets about as in D. americana, the lemma more gradually acuminate into awns.

Rocky hills, Modoc and Lassen cos., and from Oregon to Wyoming.

Locs.—Modoc Co., *Baker & Nutting* in 1894; Egg Lake, *Davy;* Loon Valley, *Davy;* Red Clover Valley, *Heller & Kennedy* 8705.

Refs.—DANTHONIA UNISPICATA Munro; Thurb. in Wats. Bot. Cal. 2: 294. 1880, as synonym under *D. californica* Boland. var. *unispicata* Thurb. in Wats. Bot. Cal. 2: 294. 1880.

3. **D. californica** Boland. Resembles D. americana; culms 2 to 3 feet tall; sheaths smooth or somewhat pilose at the throat; blades scabrous above, longer, especially those of the less numerous innovations; teeth of lemma more gradually acuminate.

Dry hills, Coast Ranges as far as San Luis Obispo, apparently rare in the Sierra Nevada; extends north to British Columbia and east to Montana and Colorado.

Locs.—Ukiah, *Davy & Blasdale* 5056; Mendocino Co., *McMurphy* 405; Sherwood, *Hitchcock* 2693, 2727; Lovelock, *Leiberg* 5058; Mt. Tamalpais, *Chase* 5675, *Piper* 6313; San Francisco, *Bolander* 1533; Monterey, *Elmer* 3306; Pacific Grove, *Heller* 6647; Yosemite Valley, *Hitchcock;* San Luis Obispo, *Jones* 3248.

Refs.—DANTHONIA CALIFORNICA Boland. Proc. Cal. Acad. 2: 182. 1863, type from vicinity of San Francisco, *Bolander;* Thurb. in Wats. Bot. Cal. 2: 294. 1880; Davy in Jepson, Fl. W. Mid. Cal. 55. 1901; Abrams, Fl. Los Ang. 40. 1904.

4. **D. intermedia** Vasey. Culms 6 to 15 inches high; sheaths smooth; blades becoming involute, more or less pilose; panicle narrow, compact, often 1-sided, 1 to 2 inches long, the pedicels short and appressed; glumes about ½ inch long; lemmas similar to those of D. americana, the teeth more gradually acuminate, the awns shorter, the dorsal awn flat, tightly twisted below, slightly twisted above.

Mountain meadows in the high Sierra Nevada; extends from British Columbia to Quebec and south to New Mexico.

Locs.—Mt. Tallac, *Hitchcock* 3144; Yosemite Nat. Park, Ostrander's, *Bolander* 6104;

Tuolumne River, *Lemmon;* Lyell Fork, *Hitchcock* 3286; Sequoia Nat. Park, Crabtree Meadow, *Hitchcock* 3440, Little Kern, *Hitchcock* 3469.

Refs.—DANTHONIA INTERMEDIA Vasey, Bull. Torr. Club 10: 52. 1883. *D. sericea* [Nutt. misapplied by] Thurb. in Wats. Bot. Cal. 2: 294. 1880.

TRIBE VII. CHLORIDEAE.

37. **CYNODON** Rich.

Spikelets 1-flowered, compressed, awnless, sessile in 2 rows along 1 side of a continuous rachis. Glumes unequal, narrow, acute, keeled. Rachilla prolonged behind the floret as a blunt pedicel. Lemma broad, boat-shaped, obtuse, ciliate on the keel. Palea as long as lemma, the prominent keels close together, ciliolate. Low perennials with creeping rhizomes or stolons, and slender digitate unilateral spikes.—Species 4, warm regions. (Greek kuon, a dog, and odous, a tooth.)

1. **C. dactylon** Pers. BERMUDA GRASS. Culms flattened, wiry, glabrous; ligule a conspicuous ring of white hairs; spikes 4 or 5, 1 to 2½ inches long; spikelets imbricated, 1 line long, the lemma longer than the glumes.

A native of the warmer parts of the Old World, now widely cultivated in the western hemisphere from Virginia to Argentina. Not uncommon in California, especially along irrigating ditches; from Sacramento (*Michener* 147) and Calaveras Co. (*Davy* 1458) south to Santa Catalina Island (*Trask*) and Yuma Res. (*Chase* 5516). Abundantly escaped in the southern part of the U. S.

Refs.—CYNODON DACTYLON Pers. Syn. 1: 85. 1805; Thurb. in Wats. Bot. Cal. 2: 292. 1880; Davy in Jepson, Fl. W. Mid. Cal. 56. 1901; Abrams, Fl. Los Ang. 41. 1904. *Panicum dactylon* L. Sp. Pl. 58. 1753. *Capriola dactylon* Kuntze, Rev. Gen. Pl. 2: 764. 1891.

38. **SPARTINA** Schreb.

Spikelets 1-flowered, laterally compressed, articulated below the glumes, sessile and closely imbricated in 2 rows on 1 side of a continuous rachis, the unilateral spikes scattered along a common axis. Glumes unequal, keeled, acute or bristle-pointed. Lemma thin, obtuse, 1-nerved, usually shorter than the second glume. Palea equaling or exceeding the lemma. Coarse perennials with strong rhizomes, rigid culms and long tough blades.—Species about 10, mostly maritime, in temperate regions of Europe and America. (Greek spartine, a cord, referring to the tough leaves.)

Spikes closely approximate, forming a cylindrical inflorescence; glumes smooth; blades wide, flat below ..... 1. *S. foliosa.*

Spikes distinct; glumes ciliate; blades narrow and soon involute..... 2. *S. gracilis.*

1. **S. foliosa** Trin. Culms stout, as much as ½ inch thick at base, usually rooting from the lower nodes, 1 to 4 feet high, somewhat spongy in texture; blades 4 to 6 lines broad at the flat base, gradually narrowed to a long involute tip, smooth on surface and margin; inflorescence dense, spike-like, about 6 inches long; spikes approximate, numerous, close-appressed, 1 to 2 inches long; spikelets indurated, very flat, about ½ inch long; glumes ciliate on keel, acute but not awned, the first narrow, about ⅔ as long as second, smooth, the second sparingly hispidulous and striate-nerved; lemma hispidulous on sides, smooth on keel, a little shorter than the second glume; palea thin, longer than the lemma, 1-keeled, 2-nerved.

Salt marshes along the coast from San Francisco Bay southward. Useful in reclaiming marsh land.

Locs.—Reclamation, *Eastwood* in 1897; Oakland, *Blankinship* 18; San Francisco, *Bioletti* 124, *Bolander* 1556; Newport, *Parish Bros.* 1602; San Diego, *Orcutt* 569, *Palmer* 274 in 1888.

Refs.—Spartina foliosa Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 114. 1840, type from California (without collector or locality); Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 58. 1911; Abrams, Fl. Los Ang. 42. 1904. *S. stricta* [Roth, misapplied by] Thurb. in Wats. Bot. Cal. 2: 290. 1880. Var. *glabra* [Muhl. misapplied by] Davy in Jepson, Fl. W. Mid. Cal. 56. 1901.

S. glabra Muhl. is said to grow at Wilmington (Abrams, Fl. Los Ang. 42. 1904).

2. **S. gracilis** Trin. Culms 2 to 3 feet high; blades flat, becoming involute, 6 to 8 inches long, very scabrous above; spikes few, 4 to 8, closely appressed to the axis, ¾ to 1 inch long; spikelets much flattened laterally, about 3 lines long; glumes smooth, except the ciliate keel, 1-nerved, acute but not awned, the first about ½ as long as the second; lemma about as long as second glume, ciliate on keel; palea as long as lemma, obtuse, 2-nerved, but compressed-keeled between the nerves.

Alkaline meadows, Washington to Saskatchewan, south to eastern California (Inyo Co., *Coville & Funston* 1002) and Arizona.

Refs.—Spartina gracilis Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 4¹: 110. 1840; Thurb. in Wats. Bot. Cal. 2: 290. 1880.

39. **CHLORIS** Swartz.

Spikelets with 1 perfect flower, sessile in 2 rows along 1 side of a continuous rachis. Glumes 2, unequal, narrow, acute, keeled. Rachilla prolonged behind the fertile floret, bearing 1 or more rudimentary awned sterile lemmas. Lemma 1 to 3-nerved, often ciliate on the back or margins, the midnerve usually prolonged into a slender awn. Usually perennial grasses with flat blades, compressed sheaths, and digitate unilateral spikes.—Species about 40, in the warmer regions of the world. (Latin Chloris, the goddess of flowers.)

1. **C. elegans** H.B.K. Annual; culms erect or spreading, 1 to 3 feet high, smooth; sheaths smooth, much compressed, especially the basal, the uppermost often inflated around the base of the inflorescence; spikes several, 6 to 12, pale or dark-colored, 1 to 3 inches long; spikelets imbricated, the glumes persistent on the rachis after the falling of the florets; glumes 1-nerved, the second about 1½ lines long, awn-pointed; lemma somewhat fusiform, about 1 line long, 3-nerved, short-pilose at base and along the lower half of the keel, long-pilose on the margins near the apex, with a slender straight awn about 5 lines long, from just below apex; rudiment reaching about to tip of fertile floret, truncate, the awn somewhat shorter.

Fields and waste places, southern California to Texas and Mexico.

Locs.—Riverside, *Reed* (Parish, Bull. S. Cal. Acad. 8: 7. 1909); Ft. Yuma, *Newberry;* Colorado River, *Schellenger.*

Ref.—Chloris elegans H.B.K. Nov. Gen. & Sp. 1: 166. 1816.

Schedonnardus paniculatus Trelease; Branner & Coville, Rep. Geol. Surv. Ark. 1888⁴: 236. 1891. *Lepturus paniculatus* Nutt. Gen. 1: 81. 1818; Thurb. in Wats. Bot. Cal. 2: 322. 1880. This species is found on the Great Plains from Canada to northern Mexico and as far west as New Mexico, but probably does not occur in California. Thurber (l. c.) gives one locality in the latter state, "Monterey (Dr. Canfield)," and in the Gray Herbarium are two specimens labeled "California Nuttall."

40. **BOUTELOUA** Lag.

Spikelets with 1 perfect flower, sessile in 2 rows along 1 side of a flat rachis, the latter usually projecting beyond the spikelets. Glumes unequal, keeled.

Rachilla prolonged beyond the perfect floret and bearing a sterile (rarely staminate) floret, a second or third rudiment often present. Lemma broader, 3 to 5-nerved, 2 to 4-toothed or cleft, usually awned between the teeth. Palea about as long as the lemma, bidentate, the 2 keels scabrous. Sterile floret sometimes reduced to awns, rarely obsolete. Annuals or usually perennials with narrow blades and few or numerous short spikes scattered along a common axis.—Species about 30, all American, mostly of the Mexican plateau. (The brothers Claudio and Esteban Boutelou, Spanish gardeners.)

Spikes containing 1 to 3 spikelets, numerous along a main axis.
- Plants perennial.....1. *B. curtipendula.*
- Plants annual.....2. *B. aristidoides.*

Spikes usually few, containing numerous spikelets.
- Plants annual.
  - Awns about 1½ lines long; spikes 2 to 4.....3. *B. arenosa.*
  - Awns barely protruding; spikes 4 to 6 or more.....4. *B. barbata.*
- Plants perennial.
  - Spikes several.
    - Spikes narrow, strictly 1-sided; spikelets numerous.....5. *B. rothrockii.*
    - Spikes broad, loose, irregularly 1-sided; spikelets few.....6. *B. radicosa.*
  - Spikes usually 1 to 3.
    - Rachis not prominently produced; glumes sparsely hairy.....7. *B. gracilis.*
    - Rachis produced beyond the spikelets as a naked point; glumes prominently papillose-hispid.....8. *B. hirsuta.*

1. **B. curtipendula** Torr. Perennial; culms erect, 1 to 4 feet high; spikes numerous on an elongated rachis, ¼ to ¾ inch long, reflexed, mostly turned to one side; glumes narrow, acuminate, scabrous on keel and somewhat so on the back, the second about 2½ lines long; lemma as long as second glume, ovate-lanceolate, 3-nerved, scabrous toward tip, 3-toothed, the palea about as long; rudiment as long as lemma, 4-lobed, 3-awned between the lobes, the lateral lobes and awns shorter.

Plains and rocky hills, Montana and Ontario, south to Mexico.

Loc.—Santa Rosa Mt., San Jacinto Range, *Hall* 2138.

Refs.—Bouteloua curtipendula Torr. in Emory, Mil. Reconn. 154. 1848. *Chloris curtipendula* Michx. Fl. Bor. Am. 1: 59. 1803. *Bouteloua racemosa* Lag. Var. Cienc. 2[a]: 141. 1805.

2. **B. aristidoides** Griseb. Annual; culms spreading, slender, 6 to 15 inches high; spikes several, slender, about ½ inch long, the 1 to 3 spikelets distant, appressed to the rachis, the latter ending in a slender naked point; glumes narrow, acuminate, the first ½ as long as the second; lemma narrowly lanceolate, 3-nerved, the nerves pilose, the lateral ending in awned teeth as long as the central acuminate point; rudiment consisting of a pilose pedicel and 3 awns longer than the spikelet.

Open ground, deserts and foothills, southern California to western Texas and south into South America. San Diego, *Orcutt* in 1890; Colorado Desert, *Brandegee* in 1905; Colorado River, Riverside Co., *Hall* 5962.

Refs.—Bouteloua aristidoides Griseb. Fl. Brit. W. Ind. 537. 1864; Thurb. in Wats. Bot. Cal. 2: 291. 1880. *Dinebra aristidoides* H.B.K. Nov. Gen. & Sp. 1: 171. 1816.

3. **B. arenosa** Vasey. Annual; culms spreading or prostrate, about 6 inches long; spikes 2 to 4, many-flowered, about ½ inch long; glumes 1-nerved, the first 1 line, the second 1½ lines long; lemma a little shorter than the second glume, pilose below, 4-lobed, the lateral lobes short, 3-awned from between the lobes, the awns about 1½ lines long; palea 4-toothed, 2-awned; rudiment ½ line long, triangular-truncate, pilose at base, 4-lobed, with 3 long awns between the lobes.

Loose sandy soil, deserts of northern Mexico, extending sparingly into the adjoining U. S. Cargo Muchacho, Colorado Desert, *Orcutt*.

Ref.—Bouteloua arenosa Vasey, U. S. Dept. Agr. Div. Bot. Bull. 12[1]: 34. 1890.

4. **B. barbata** Lag. Annual; culms spreading or prostrate, 6 to 12 inches long; spikes several, usually 4 to 6, about ½ to ¾ inch long; spikelets numerous, imbricated; glumes unequal, scabrous on keel and somewhat so on back, awn-pointed from a toothed apex, the second twice as long as the first, 1½ lines long; lemma pilose below, 3-awned, the central between the obtuse scabrous lobes; rudiment pilose at base, 2-lobed, 3-awned, enclosing an orbicular scale; awns of spikelet about 1 line long.

Deserts, Utah to southern California (The Needles, *Jones* 67a in 1884) and south into Mexico.

Refs.—Bouteloua barbata Lag. Var. Cienc. 2[1]: 141. 1805. *B. polystachya* Torr. U. S. Rep. Expl. Miss. Pacif. 5: 366. 1857; Thurb. in Wats. Bot. Cal. 2: 291. 1880. *Chondrosium polystachya* Benth. Bot. Voy. Sulph. 56. 1844.

5. **B. rothrockii** Vasey. Perennial; culms erect or spreading, 1 to 2 feet high; spikes several, usually 4 to 6, ½ to 1 inch long; spikelets numerous, imbricated; glumes unequal, scabrous on keel and back, cuspidate and 2-toothed at apex, the second 1¼ lines long, about twice as long as the first; lemma pilose below, 4-lobed, 3-awned, the awns equal, 1¼ lines long; rudiment pilose at base, consisting of 2 short truncate lobes, 3 equal awns about 1 line long and an included orbicular scale.

Mesas and foothills, Utah to southern California (Jamacha, *Canby*) and Mexico.

Ref.—Bouteloua rothrockii Vasey, Contr. Nat. Herb. 1: 268. 1893.

6. **B. radicosa** Griff. Perennial; culms 6 inches to 2 feet high, erect; blades mostly basal, flat; spikes several to many, ¾ to 1 inch long, irregularly 1-sided; glumes somewhat unequal, rather broad, the second about 3 lines long; lemma smooth, bearing 3 short awns; rudiment lanceolate, with 3 long awns.

Upper foothills and mountains, southern California (*Orcutt* in 1884) and New Mexico to Mexico.

Refs.—Bouteloua radicosa Griff. Contr. Nat. Herb. 14: 411. 1912. *Atheropogon radicosus* Fourn. Mex. Pl. 2: 140. 1886. *Dinebra bromoides* H.B.K. Nov. Gen. & Sp. 1: 172. 1816, not *Bouteloua bromoides* Lag.

7. **B. gracilis** Lag. Perennial; culms erect, 6 inches to 1½ feet high; sheaths and blades glabrous; spikes 1 to 3, 1 to 2 inches long, usually a little curved, the rachis not produced; spikelets 2½ to 3 lines long, densely crowded, pectinate; glumes narrow, the first about ½ as long as the second, the latter sparsely papillose-pilose on the keel; lemma pilose, 3-cleft, the lateral divisions awned, the terminal 2-toothed, awned between the teeth; rudiment 3-awned, pilose at base, a second rudimentary scale above.

Plains and hills, mountains of southern California; extends from Manitoba to Montana, south to Mexico.

Locs.—San Bernardino Mts., *Abrams* 2100, *Parish Bros.* 1528, *Wilder* 744; Santa Ana Cañon, *Hall* 7589; Jamacha, *Canby* in 1894.

Refs.—Bouteloua gracilis Lag.; Steud. Nom. Bot. ed. 2. 1: 219. 1840. *Chondrosium gracile* H.B.K. Nov. Gen. & Sp. 1: 176. 1816. *Bouteloua oligostachya* Torr.; Gray, Man. ed. 2. 553. 1856; Thurb. in Wats. Bot. Cal. 2: 291. 1880. *Atheropogon oligostachyum* Nutt. Gen. 1: 78. 1818.

8. **B. hirsuta** Lag. Perennial; culms erect, 8 inches to 1½ feet high; sheaths smooth; blades sparsely papillose-hairy, especially on the margins; spikes 1 to 4, ⅔ to 2 inches long, the rachis produced into a prominent point

beyond the uppermost spikelets; first glume narrow, setaceous; second glume acuminate, twice as long as first and equaling the floret, conspicuously tuberculate-hirsute on the back; lemma pubescent, 3-cleft; rudiment of 2 obtuse lobes and 3 equal awns, not pilose at base.

Mesas of San Diego Co. (Jamacha, *Canby*); extends from British Columbia to South Dakota and Mexico.

Ref.—Bouteloua hirsuta Lag. Var. Cienc. 2[1]: 141. 1805.

41. **BECKMANNIA** Host.

Spikelets 1 or 2-flowered, broad, laterally compressed, articulated below the glumes, closely imbricated in 2 rows along 1 side of the rachis. Glumes subequal, inflated, boat-shaped, chartaceous, the margins scarious. Lemma lanceolate, acuminate. Palea nearly as long as lemma. A tall perennial with flat blades and numerous short appressed spikes in a narrow terminal, nearly simple panicle.—Species 1, cooler parts of the northern hemisphere. (Johann Beckmann, 1739—1811, professor of botany at Göttingen.)

1. **B. erucaeformis** Host. Plants light green; culms 1 to 3 feet high; panicle 4 to 10 inches long; spikelets nearly circular, 1½ lines long; glumes transversely wrinkled, the acuminate apex of the lemma protruding.

Swamps and ditches, San Francisco Bay north to Yreka and east to Honey Lake Valley; also in the cooler parts of the northern hemisphere.

Refs.—Beckmannia erucaeformis Host, Gram. Austr. 3: 5. 1805; Thurb. in Wats. Bot. Cal. 264. 1880; Davy in Jepson, Fl. W. Mid. Cal. 57. 1901. *Phalaris erucaeformis* L. Sp. Pl. 55. 1753.

42. **ELEUSINE** Gaertn.

Spikelets several-flowered, sessile and closely imbricated in 2 rows on 1 side of a continuous rachis, the latter not extending beyond the spikelets. Glumes 2, unequal, shorter than the florets, compressed-keeled, obtuse. Lemmas broader, with a thickened 5-ribbed keel, the uppermost sometimes empty. Coarse tufted annuals, with digitate or approximate, rather stout spikes.—Species about 6, tropical regions of the Old World, 1 species introduced in the warmer portions of the U. S. (Greek Eleusin, the town where Ceres, the goddess of harvests, was worshipped.)

1. **E. indica** Gaertn. Culms flattened, decumbent at base or prostrate-spreading; sheaths loose, overlapping, compressed; spikes 2 to 10, 1 to 3 inches long; spikelets appressed, 3 to 5-flowered, about 2½ lines long.

A common roadside weed in the warmer parts of America, introduced from the Old World. Los Angeles, *Braunton* 1281.

Refs.—Eleusine indica Gaertn. Fruct. & Sem. 1: 8. 1788. *Cynosurus indicus* L. Sp. Pl. 72. 1753.

43. **LEPTOCHLOA** Beauv.

Spikelets 2 to several-flowered, the uppermost floret usually imperfect or rudimentary, sessile or nearly so, more or less scattered along 1 side of the rachis. Glumes keeled, 1-nerved. Lemmas keeled, 3-nerved, acute, awned or awnless, sometimes 2 or 3-toothed. Annuals or sometimes perennials with elongated simple panicles of slender spikes scattered along a main axis.—Species about 20, in the warm regions of both hemispheres. (Greek leptos, slender, and chloa, grass.)

Glumes longer than first lemma; sheaths papillose-hispid.....1. *L. filiformis.*
Glumes shorter than first lemma; sheaths smooth.
Lemmas awned .....2. *L. fascicularis.*
Lemmas awnless .....3. *L. imbricata.*

1. **L. filiformis** Beauv. Culms 1 to 3 feet high, often depauperate; sheaths papillose-hairy; spikes numerous, 1 to 4 inches long, slender, usually purple, the spikelets rather distant, about 1½ lines long; glumes more or less mucronate, nearly equaling the 3 or 4 awnless florets.

Open ground, fields and moist depressions, Imperial Co. (Colorado River, *Schellenger*); common in the warmer parts of America.

Refs.—LEPTOCHLOA FILIFORMIS Beauv. Ess. Agrost. 71, 166, 1812. *Festuca filiformis* Lam. Tabl. Encycl. 1: 191. 1791. *Leptochloa mucronata* Kunth, Rév. Gram. 1: 91. 1829; Abrams, Fl. Los Ang. 42. 1904. *Eleusine mucronata* Michx. Fl. Bor. Am. 1: 65. 1803.

2. **L. fascicularis** Gray. Culms erect or spreading, 1 to 2 feet high; sheaths smooth; blades erect, as long or longer than the culms; spikes numerous, 3 to 5 inches long; spikelets slightly pediceled, 7 to 11-flowered, the florets much longer than the lanceolate glumes; lemmas hairy-margined toward the base, short-awned from the toothed apex.

Ditches and moist, especially alkaline places, Fresno Co. (*Griffiths* 4729) and Kern Co. (*Raymond*); east to Maryland and Florida.

Refs.—LEPTOCHLOA FASCICULARIS Gray, Man. 588. 1848; Thurb. in Wats. Bot. Cal. 2: 292. 1880. *Festuca fascicularis* Lam. Tabl. Encycl. 1: 189. 1791.

3. **L. imbricata** Thurb. Resembles L. fascicularis; usually strictly erect, the panicle more oblong in outline, with shorter spikes; glumes broader and more obtuse; lemmas apiculate but not awned.

Ditches and moist places, San Bernardino Mts. southward to Mexico and east to Louisiana.

Locs.—San Bernardino Mts., *Wilder* 1128, *Wright* 2118; Riverside, *Wheeler* in 1908; Salton Basin, *Schellenger* 55 in 1893; Calexico, *Chase* 5518.

Ref.—LEPTOCHLOA IMBRICATA Thurb. in Wats. Bot. Cal. 2: 293. 1880.

TRIBE VIII. FESTUCEAE.

44. **MONANTHOCHLOË** Engelm.

Spikelets 2 or 3-flowered, unisexual, the staminate and pistillate somewhat dissimilar, usually sessile in pairs and concealed within the leaf-fascicles, the upper floral leaves becoming smaller, at length reduced to sheaths, and resembling the glumes. Lemmas membranaceous, rigid, obtuse or denticulate. Palea enclosed within the lemma.—Species 1, tropical and subtropical America. (Greek monanthos, one-flower, and chloe, grass.)

1. **M. littoralis** Engelm. A creeping stoloniferous perennial with wiry stems and short rigid crowded leaves.

Salt marshes and mucky or gravelly tidal flats along the coast of tropical seas in the western hemisphere, extending as far north on the Pacific Coast as Santa Barbara.

Locs.—Santa Barbara, *Hitchcock* 2563; San Pedro, *Grant* 295, 3400; Oceanside, *Parish* 4449; San Diego, *Abrams* 3456, *Cleveland* 829.

Refs.—MONANTHOCHLOË LITTORALIS Engelm. Trans. Acad. St. Louis 1: 436. 1859; Abrams, Fl. Los Ang. 44. 1904.

45. **ORCUTTIA** Vasey.

Spikelets several-flowered, compressed, sessile in loose spikes, the lower spikelets more or less remote. Glumes subequal, broadly lanceolate, irregularly 2 to 5-toothed. Lemmas oblong, many-nerved, 5-toothed at the broad apex, the principal nerves extending into the teeth. Low cespitose annuals with short leaves and rather large spikelets.—Species 2, one from Lower California, the other from Chico. (C. R. Orcutt, a botanist of San Diego.)

1. **O. greenei** Vasey. Culms 6 to 8 inches high, scabrous or appressed-pilose,

especially at the nodes; sheaths finely papillose, shorter than the internodes, the ligule very short; blades about an inch long, pilose on the upper surface, inrolled; spike 1 to 3 inches long, pale; glumes and lemmas sparsely long-pilose and more or less papillose, the glumes 2 lines, the lemmas 3 lines long.

Only known from the type collection, "Moist plains of the upper Sacramento, near Chico, California, June, 1890, by Prof. E. L. Greene."

Ref.—ORCUTTIA GREENEI Vasey, Bot. Gaz. 16: 146. 1891.

46. **ARUNDO** L.

Spikelets 3 or 4-flowered in large terminal panicles. Glumes narrow, subequal, 3-nerved, smooth, acute or acuminate, about as long as the spikelet. Rachilla smooth. Lemma thin, membranaceous, 3-nerved, 2-toothed at apex, mucronate between the teeth, long-pilose on the back. Tall reed-like grasses, with hollow culms, and broad flat blades.—Species about 6, in the warmer regions of the Old World, 1 introduced in America. (An ancient Latin name.)

1. **A. donax** L. GIANT-REED. Culms stout, as much as 20 feet high, and an inch in diameter at base, from rough knotty branching rhizomes; blades numerous, broad, flat, 2 to 3 inches wide on the main stem, smaller on the branches, the base cordate and more or less hairy-tufted; panicle large, 1 to 2 feet long; spikelets about 6 lines long.

A native of the Old World, frequently cultivated for ornament in tropical America. Rather common in gardens in the southern U. S. and escaped along irrigating ditches from Texas to central and southern California. The only California specimen in the National Herbarium is from the Alameda marshes, *Davy* in 1898.

Refs.—ARUNDO DONAX L. Sp. Pl. 81. 1753; Davy in Jepson, Fl. W. Mid. Cal. 59. 1901; Abrams, Fl. Los Ang. 44. 1904.

47. **PHRAGMITES** Trin.

Spikelets loosely 3 to 7-flowered, in large terminal panicles. Glumes unequal, lanceolate, acute, shorter than the spikelet. Rachilla clothed with long silky hairs. Lemmas narrow, long-acuminate, glabrous, the lowest longer, equaling the uppermost florets, empty or subtending a staminate flower. Tall reed-like perennials.—Species 3, 1 cosmopolitan, 1 in Asia, and 1 in South America. (Greek phragmites, growing in hedges.)

1. **P. communis** Trin. COMMON REED. Culms as much as 12 feet high, from long creeping rhizomes, these sometimes appearing on the surface of the ground as long leafy stolons as much as 30 feet long; blades as much as 2 inches wide, flat, the base somewhat narrowed, not hairy; panicle 6 to 15 inches long; spikelets 6 to 7 lines long.

Fresh-water swamps, marshes and around springs, through the temperate regions of the world.

Locs.—Mendocino, *Brown* 943; Suisun marshes, *Davy* 4095; Concord, *Elmer* 4541; San Bernardino, *Parish* 5111; Newberry, *Chase* 5779.

Refs.—PHRAGMITES COMMUNIS Trin. Fund. Agrost. 134. 1820; Thurb. in Wats. Bot. Cal. 2: 300. 1880. *P. vulgaris* B. S. P. Prel. Cat. N. Y. 69. 1888; Davy in Jepson, Fl. W. Mid. Cal. 59. 1901. *Arundo vulgaris* Lam. Fl. Franç. 3: 615. 1778. *Phragmites phragmites* Karst. Deutsche Fl. 379. 1880. *Arundo phragmites* L. Sp. Pl. 81. 1753.

48. **TRIDENS** Roem. & Schult.

Spikelets 3 to many-flowered, the uppermost staminate or reduced, in open or contracted panicles. Glumes glabrous. Lemmas 3-nerved, more or less bidentate, the middle nerve often produced between the teeth into an awn, the nerves and callus densely villous. Palea shorter than the lemma, long-ciliate

on the nerves below. Perennials with various habit, the above characters covering the California species.—Species about 25, mostly American. (Latin tres, three, and dens, tooth.)

Inflorescence a naked narrow panicle.....1. *T. muticus.*
Inflorescence a leafy head or umbel.....2. *T. pulchellus.*

1. **T. muticus** Nash. Culms erect, 1 to 2 feet high; blades involute, scabrous; panicle narrow, 3 to 6 inches long, exserted, the branches short and appressed; spikelets terete, narrow, 4 to 5 lines long; glumes about 2 lines long, 1-nerved, shorter than the spikelets; lemmas pilose on nerves, obtuse, about 2 lines long, entire or slightly emarginate, awnless.

Dry slopes and gravelly banks, central Sierra Nevada (Silver Mt., *Brewer* 2044), east to Colorado and Texas.

Refs.—TRIDENS MUTICUS Nash in Small, Fl. Southeast. U. S. 143. 1903. *Tricuspis muticus* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 156. 1857.

2. **T. pulchellus** Hitchc. n. comb. Low and tufted, usually not over 6 inches high; culms slender, scabrous or puberulous, consisting of 1 long internode, bearing at the top a fascicle of leaves, the fascicle finally bending over to the ground, taking root and producing other culms, the fascicles also producing the inflorescence; sheaths striate, papery-margined, pilose at base; blades involute, short, scabrous, sharp-pointed, striate; panicles much reduced, usually not exceeding the blades of the fascicle, consisting of 1 to 5 nearly sessile spikelets; glumes subequal, broad, acuminate, awn-pointed, 1-nerved, 3 to 4 lines long, and about as long as the spikelet; lemmas 2 lines long, long-pilose below, cleft about half way, the awn about as long or a little longer than the obtuse lobes.

Mesas and rocky hills in the Mohave and Colorado deserts, east to Utah and Texas, and south into Mexico.

Locs.—Funeral Mts., *Coville & Funston* 258; Panamint Cañon, *Hall & Chandler* 6995; Newberry, *Chase* 5789; The Needles, *Chase* 5791; Colorado Desert, *Hall* 5961, *Wilder* 1094.

Refs.—TRIDENS PULCHELLUS Hitchc. *Triodia pulchella* H.B.K. Nov. Gen. & Sp. 1: 155. 1816. *Tricuspis pulchella* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 156. 1857; Thurb. in Wats. Bot. Cal. 2: 301. 1880.

49. **DISSANTHELIUM** Trin.

Spikelets 2 to 4-flowered, the uppermost reduced to a stipe, arranged in panicles. Glumes narrow, acute, equaling or exceeding the spikelet, the first 1-nerved, the second 3-nerved. Lemma broad, awnless, 3-nerved.—Species 3, 1 in California, the others Mexican and South American. (Greek dissos, double, and anthelios, floret.)

1. **D. californicum** Benth. Culms 2 to 3 feet high, smooth; leaves smooth; ligule membranaceous, 1 to 3 lines long; blades flat, lax; panicle narrow, loose, 6 to 8 inches long, the lower clusters of branches rather remote; glumes somewhat unequal, the first about 1 to 1½ lines long; lemmas about 1½ lines long, minutely villous, especially below.

Known only from California: Tassajara Hot Springs, *Elmer* 3317; San Clemente Island, *Trask* 324. The specimens at hand are apparently annual.

Refs.—DISSANTHELIUM CALIFORNICUM Benth. in Hook. Icon. Pl. III. 4: 56. pl. 1375. 1881. *Stenochloa californica* Nutt. Jour. Acad. Phila. II. 1: 189. 1848, type from Santa Catalina Island, *Gambel;* Thurb. in Wats. Bot. Cal. 2: 315. 1880.

50. **ERAGROSTIS** Host.

Spikelets 3 to many-flowered, usually strongly compressed, in open or contracted panicles. Glumes keeled, much shorter than the spikelets. Lemmas

3-nerved, broad, keeled. Palea shorter than the lemma, often persistent on the rachilla, the strong nerves ciliate. Annuals or perennials.—Species about 100, in warm and temperate regions of both hemispheres. (Greek er, spring, and agrostis, a grass.)

Plants perennial.
Panicle narrow and compact, more or less interrupted.....1. *E. secundiflora.*
Panicle loose and open.....2. *E. lugens.*
Plants annual.
Spikelets dioecious or polygamous.....8. *E. hypnoides.*
Spikelets perfect.
Spikelets ovate to oblong-ovate, about 1½ lines wide; keel of lemmas glandular and scabrous.....5. *E. megastachya.*
Spikelets linear, ½ to 1 line wide; keel of lemmas scabrous but not glandular.
Panicle pilose in the lower axils.
Lower lemmas ½ line wide.....7. *E. limbata.*
Lower lemmas ¼ line wide.....6. *E. pilosa.*
Panicle glabrous in the axils.
Pedicels flexuous and spreading; lower lemmas ¼ line wide.....4. *E. orcuttiana.*
Pedicels nearly straight, ascending or appressed; lower lemmas ⅓ line wide.....3. *E. mexicana.*

1. **E. secundiflora** Presl. Perennial; culms erect or decumbent at base, stiff, 1 to 2 feet high; sheaths pilose at the throat; panicles narrow, the branches ascending, compactly flowered, approximate or more or less remote; spikelets many-flowered, the florets closely imbricated, usually tinged with red; glumes 1-nerved, the second 1 line long; lemmas prominently 3-nerved, scabrous on keel, broad at base, the acuminate apex somewhat divergent.

Sandy prairies, Kansas to Florida and Mexico and west to southern California. San Diego, *Orcutt* in 1884.

Refs.—Eragrostis secundiflora Presl, Rel. Haenk. 1: 276. 1830. *E. oxylepis* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 156. 1857. *Poa oxylepis* Torr. in Marcy, Expl. Red Riv. 301. 1853. *P. interrupta* Nutt. Trans. Am. Phil. Soc. II. 5: 196. 1837, not Lam. 1791.

2. **E. lugens** Nees. Perennial; culms erect, 2 to 3 feet high; leaves mostly basal, the blades narrow, involute; panicle large and diffuse, about ½ the length of the entire plant; spikelets 3 to 4 lines long, about ¾ line wide; second glume 1 line long; lower lemmas 1 line long, ⅓ line wide.

Sandy prairies, San Diego Co. (Jamacha, *Canby*) to Texas and south to South America.

Ref.—Eragrostis lugens Nees, Agrost. Bras. 505. 1829.

3. **E. mexicana** Link. Annual; culms erect or spreading, 1 to 2 feet high; sheaths hairy at the throat; blades often elongated; panicle large and diffuse, glabrous in the axils, 6 to 12 inches long; spikelets 2 to 3 lines long, ¾ line wide, mostly 6 to 12-flowered, the pedicels slender, flexuous, mostly longer than the spikelet; glumes acuminate, the second about 1 line long; lemmas smooth, the lower 1 line long, ⅓ line wide, the lateral nerves not prominent.

A weed in fields and waste places, southern California (Los Angeles, Riverside) to New Mexico and southward to Mexico.

Refs.—Eragrostis mexicana Link, Hort. Berol. 1: 190. 1827. *Poa mexicana* Lag. Gen. & Sp. Nov. 3. 1816.

4. **E. orcuttiana** Vasey. Resembling E. mexicana; differing in the more slender, usually arcuate spikelets on shorter pedicels; spikelets 2½ to 3 lines long, ⅓ to ½ line wide; glumes short, the first ½ line, the second ¾ line long; lemmas scarcely ¼ line wide.

Fields and waste places, known only from California.

Locs.—Yreka, *Butler* 869; Castle Crag, *Hitchcock* 3063; Amador Co., *Hansen* 813, 2086;

Ione, *Braunton* 1209; Greenfield, *Leckenby* in 1896; Pomona, *Davy* 2951; Lugonia (Redlands), *Parish* 2484.

Refs.—ERAGROSTIS ORCUTTIANA Vasey, Contr. Nat. Herb. 1: 269. 1893, type from Chollas Valley, San Diego, *Orcutt* 1313. Referred to *E. pilosa* by Abrams (Fl. Los Ang. 45. 1904).

5. **E. megastachya** Link. Annual, strong-scented when fresh; culms erect or ascending from a decumbent base, rather flaccid, freely branching, 8 inches to 2 feet high; blades 2 to 6 inches long, 1½ to 3 lines wide; panicles greenish lead-color, 2 to 6 inches long, rather densely flowered; spikelets 2½ to 7 lines long, 1½ lines wide, 10 to 40-flowered, the florets closely imbricated; pedicels and keels of the acute glumes and lemmas sparingly glandular; lemmas thin, the lateral nerves prominent.

Fields, roadsides and waste places, a common weed, throughout the U. S. and Mexico, introduced from Europe. Middle Tule, *Purpus* 5614; Los Angeles, *Davidson;* San Bernardino, *Parish*.

Refs.—ERAGROSTIS MEGASTACHYA Link, Hort. Berol. 1: 187. 1827. *Poa megastachya* Koeler, Descr. Gram. 181. 1802. *Briza eragrostis* L. Sp. Pl. 70. 1753 (not *Poa eragrostis L.). Eragrostis major* Host, Gram. Austr. 4: 14. pl. 24. 1809; Abrams, Fl. Los Ang. 45. 1904. *E. poaeoides* Beauv. var. *megastachya* Gray, Man. ed. 5. 631. 1867; Thurb. in Wats. Bot. Cal. 2: 315. 1880. *E. minor* Host var. *megastachya* Davy in Jepson, Fl. W. Mid. Cal. 60. 1901.

E. MINOR Host. (Fl. Austr. 1: 135. 1827) is mentioned by Davy (Jepson, Fl. W. Mid. Cal. 60. 1901) and by Thurber (Wats. Bot. Cal. 2: 315. 1880, as E. poaeoides Beauv.) but the specimens probably belong to E. pilosa Beauv.

6. **E. pilosa** Beauv. Annual; culms erect, decumbent at base or prostrate-spreading, 6 inches to 1½ feet high, diffusely branched at base; sheaths sparingly pilose at summit; blades 1 to 4 inches long, 1 to 1½ lines wide; panicle diffuse, 3 to 8 inches long, the lower axils sparingly bearded; spikelets 5 to 18-flowered, becoming linear, 2 to 4 lines long, ½ to ¾ line wide, equaling or shorter than the pedicels; glumes 1-nerved, smooth except the keels, the first ½ line, the second ¾ line long; lemmas smooth, slightly scabrous on keel, the lower about ¾ line long, ¼ line wide, the lateral nerves distinct but not prominent.

Fields, waste places and open ground, San Luis Obispo and Tulare Co. southward; extends from Maine to Minnesota and south to Mexico. Introduced from Europe but also apparently native in some localities.

Refs.—ERAGROSTIS PILOSA Beauv. Ess. Agrost. 162. 1812; Abrams, Fl. Los Ang. 45. 1904. *Poa pilosa* L. Sp. Pl. 68. 1753.

E. ALBA Presl, Rel. Haenk. 1: 279. 1830. The type locality as published is "Monte-Rey Californiae." The type specimen in the Bohemian National Museum at Prague is labeled, "Regiomontane", which would indicate that the specimen came from Peru, as many of Haenke's specimens from Peru are labeled in this way. As indicated by Scribner (Rep. Mo. Bot. Gard. 10: 43. pl. 44. 1899), the Haenke specimen appears to be *Poa pastoensis* H.B.K. (see Kunth, Rév. Gram. pl. 145) the type locality of which is Peru. The labels on Haenke's type specimens are scanty and confusing, and some evidently have been interchanged. The specimens in the Gray Herbarium mentioned under *E. alba* by Thurber (Wats. Bot. Cal. 2: 315. 1880) are all Eragrostis pilosa.

7. **E. limbata** Fourn. Resembles E. pilosa, differing in its relatively smaller panicles and larger spikelets; lower lemma 1 line long, ½ line wide.

Mesas, San Diego Co. (Jamacha, *Canby*) to Mexico.

Refs.—ERAGROSTIS LIMBATA Fourn. Mex. Pl. 2: 116. 1886. Mentioned without description by Hemsley (Biol. Centr. Am. Bot. 3: 573. 1885).

8. **E. hypnoides** B.S.P. Annual, extensively creeping; culms slender, 8 inches to 1½ feet long, with short, erect or ascending, panicle-bearing branches,

2 to 4 inches high; blades ½ to 1½ inches long; panicles mostly simple, of rather few lanceolate-oblong spikelets, the fertile inflorescence tending to be capitate; spikelets 10 to 35-flowered, 2½ to 7 lines long, the flowers more or less dioecious.

Sand bars and wet shores of rivers and lakes, throughout the U. S. and south to South America.

Locs.—Mendocino, *Brown* 928; Lower Sacramento, *Jepson* in 1891; Lathrop, *Bioletti* 144; Clear Lake, *Pringle* in 1882; Los Angeles, *Nevin*.

Refs.—Eragrostis hypnoides B.S.P. Prel. Cat. N. Y. 69. 1888; Davy in Jepson, Fl. W. Mid. Cal. 60. 1901. *Poa hypnoides* Lam. Tabl. Encycl. 1: 185. 1791. *Eragrostis reptans* Nees, Agrost. Bras. 514. 1829; Thurb. in Wats. Bot. Cal. 2: 314. 1880.

51. **ANTHOCHLOA** Nees & Meyen.

Spikelets several-flowered, in capitate or cylindrical panicles. Glumes small or wanting. Lemmas thin-membranaceous, flabelliform, or petal-like, many-nerved. Palea narrower than the lemma, hyaline. Low cespitose grasses with flat blades and panicles partially included in the sheaths.—Species 3, Andes of Bolivia and Peru, 1 in California. (Greek anthos, flower, and chloa, grass.)

1. **A. colusana** Scribn. Annual; culms ascending from a decumbent base, 3 to 12 inches long; leaves overlapping, pale green, scarious between the nerves, loosely folded around the culm but not differentiated into sheath and blade, about 6 lines wide at the middle, tapering to each end, 2 to 4 inches long, keeled on the back above, plicate, minutely ciliate with raised glands on the margins and nerves; panicles pale green, cylindrical, at first partially included, never much exserted, 1½ to 3 inches long, 4 to 6 lines wide, the upper portion of the axis bearing, instead of spikelets, lanceolate-linear empty bracts 4 lines long; spikelets subsessile, usually 5-flowered, 3 to 3½ lines long, imbricated; glumes wanting; lemmas flabellate, very broad, many-nerved, 2½ lines long, ciliolate-fringed.

Only known from the type collection, "near Princeton, Colusa County, California, bordering rain-pools on the hard uncultivated alkali 'goose-lands,' beside the stage road to Norman; May 26, 1898, *J. Burtt Davy.*"

Refs.—Anthochloa colusana Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 221. f. 517. 1899. *Stapfia colusana* Davy, Erythea 6: 110. pl. 3. 1898. *Neostapfia colusana* Davy, Erythea 7: 43. 1899.

52. **MELICA** L.

Spikelets 2 to several-flowered, in panicles. Glumes large, unequal, membranaceous or papery, scarious-margined, 3 to 5-nerved, awnless, a little shorter than the florets. Rachilla prolonged beyond the uppermost fertile floret and bearing 2 or 3 gradually smaller empty lemmas more or less convolute and enclosing one another at the apex. Lemmas firm with scarious margins, 7-nerved, awnless, or awned below the bifid apex. Perennials, often bulbous at base, with closed sheaths and usually few-flowered panicles.—Species about 30 in temperate regions. (An old Italian name for sorghum, from mel, honey.)

Spikelets narrow; glumes usually narrow, scarious margined; sterile lemmas similar to the fertile, the latter acute or awned.
- Lemmas long-awned ..... 1. *M. aristata.*
- Lemmas awnless or very short-awned.
  - Culms not bulbous at base ..... 2. *M. harfordii.*
  - Culms bulbous at base.
    - Lemmas acuminate; panicle narrow, the branches short ..... 3. *M. subulata.*
    - Lemmas acute, not acuminate; panicle broad, the branches long and spreading ..... 4. *M. geyeri.*

Spikelets broad; glumes broad and papery; sterile lemmas small and convolute around each other, more or less hidden in the upper fertile lemmas.
Culms bulbous at base.
Pedicels capillary, flexuous or recurved.....5. *M. spectabilis.*
Pedicels stouter, appressed.
Panicle narrow; branches short, erect.....6. *M. bella.*
Panicle open; branches spreading.
Spikelets about 3 lines long.....7. *M. fugax.*
Spikelets about 6 lines long.....8. *M. inflata.*
Culms not distinctly bulbous at base (somewhat bulbous in M. bulbosa).
Spikelets large, reflexed.....9. *M. stricta.*
Spikelets smaller, not reflexed.
Fertile florets 3 or 4 in each spikelet; spikelets 5 to 6 lines long.
Spikelets silvery white; glumes about as long as spikelet; plant tall and somewhat woody.....10. *M. frutescens.*
Spikelets tawny or purplish; glumes shorter than spikelet; plant lower, herbaceous.....11. *M. bulbosa.*
Fertile florets 1 or 2 in each spikelet; spikelets 2 to 3 lines long.
Fertile lemmas pubescent.....12. *M. torreyana.*
Fertile lemmas glabrous.....13. *M. imperfecta.*

1. **M. aristata** Thurb. Culms erect or decumbent below, not bulbous at base, smooth, 2 to 3 feet high; sheaths scabrous or pubescent; blades flat, more or less pubescent; panicle narrow, the branches short and appressed; glumes narrow, 5-nerved, 5 to 6 lines long; lemmas 5-nerved, scabrous, bifid at apex, awned, the awn 3 to 5 lines long.

Dry woods, slopes and meadows. Washington, southward in the Sierra Nevada to Fresno Co.

Locs.—Siskiyou Co., *Butler* 811; Mt. Shasta, *Hitchcock* 2944; Grizzly Hill, *Leiberg* 5121; Emigrant Gap, *Jones* in 1882; Lake Tahoe, *Reed & Pendleton* 1726; Mt. Tallac, *Hitchcock* 3163; Pioneer, *Hansen* 1849; Yosemite Valley, *Hitchcock* 3349; Northfork, *Griffiths* 4581, 6670; Pine Ridge, *Hall & Chandler* 314.

Refs.—MELICA ARISTATA Thurb.; Boland. Proc. Cal. Acad. 4: 103. 1870, type from Clark's (now Wawona), *Bolander* 4861; Thurb. in Wats. Bot. Cal. 2: 305. 1880.

2. **M. harfordii** Boland. Culms 2 to 4 feet high, decumbent below, smooth, not bulbous at base; sheaths smooth; blades scabrous, firm; panicle narrow, the branches appressed; glumes narrow, about 3 lines long, obtuse; lemmas 7-nerved, pilose on lower part of margin, the apex emarginate, mucronate or short-awned; awn less than 1 line long.

Open dry woods and slopes. Coast Ranges from Monterey Co. to Castella and north to British Columbia.

Refs.—MELICA HARFORDII Boland. Proc. Cal. Acad. 4: 102. 1870, three specimens mentioned, *Bolander* 53, 6464, and one from Bear Valley, Nevada Co., in 1869; Thurb. in Wats. Bot. Cal. 2: 305. 1880.

3. **M. subulata** Scribn. Culms 2 to 4 feet high, bulbous at base; panicle narrow, the branches appressed; spikelets narrow, ¾ to 1 inch long, loosely several-flowered; glumes narrow, obscurely nerved, the second about 4 lines long, shorter than the lower lemma; lemmas prominently 7-nerved, gradually narrowed to an acuminate point, awnless, the keel and marginal nerves piloseciliate.

Meadows, banks and shady slopes, from Siskiyou Co. and Trinity Summit to Lake Tahoe (*Reed & Pendleton* 1686) and Mt. Tamalpais (*Piper* 6343); north to Alaska and east to Wyoming.

Refs.—MELICA SUBULATA Scribn. Proc. Acad. Phila. 1885: 47. 1885. *Bromus subulatus* Griseb. in Ledeb. Fl. Ross. 4: 358. 1853. *Melica acuminata* Boland. Proc. Cal. Acad. 4: 104.

1870, type *Bolander* 4698 (from Mendocino City acc. to Bolander's Field Book); Thurb. in Wats. Bot. Cal. 2: 305. 1880.

4. **M. geyeri** Munro. Culms 3 to 5 feet high, bulbous at base; sheaths glabrous or sometimes pubescent; blades scabrous, flat; panicle open, the lower branches slender, spreading, bearing a few spikelets above the middle; spikelets narrow, 6 to 10 lines long; glumes broad, smooth, papery, the second about 3 lines long; lemmas scaberulous, obtuse, awnless.

Wooded ravines and along streams, central California to Oregon.

Locs.—Quincy, *Austin* 1008; Sherwood, *Hitchcock* 2728; Ukiah, *Bolander* 3832, 6119, *Davy* 5027; Cahto, *Davy* 6625; Mt. Sanhedrin, *Heller* 5885; Emigrant Gap, *Jones* 3553; Santa Clara Co., *Heller* 7420; Congress Springs, *Hitchcock* 2669.

Refs.—MELICA GEYERI Munro; Boland. Proc. Cal. Acad. 4: 103. 1870, type *Bolander* 6119. *M. bromoides* Boland.; Gray, Proc. Am. Acad. 8: 409. 1872 (Gray cites *M. geyeri* Boland. l. c.); Thurb. in Wats. Bot. Cal. 2: 304. 1880.

5. **M. spectabilis** Scribn. Culms 1 to 3 feet high, bulbous at base; panicle narrow, the branches appressed; spikelets broad, purple-tinged, 4 to 5 lines long, 4 or 5-flowered, the pedicels slender, curved; glumes broad and papery, shorter than the lower lemma; lemmas strongly 7-nerved, obtuse, awnless.

Rocky or open woods and thickets; Sherwood, *Hitchcock* 2715 and Trinity Summit, *Davy* 5827, north to Washington and east to Montana and Colorado.

Ref.—MELICA SPECTABILIS Scribn. Proc. Acad. Phila. 1885: 45. 1885.

6. **M. bella** Piper. Culms 1 to 2 feet high, bulbous at base; sheaths and blades glabrous or scabrous; panicle narrow, the branches short and appressed; spikelets 5 to 6 lines long, papery with age; glumes broad, the second 4 lines long; lemmas obscurely nerved, obtuse or slightly emarginate, awnless.

Rocky woods and hills; central California to Washington, east to Montana and Colorado.

Locs.—Mt. Shasta, *Palmer* 2641 in 1892; Long Valley, Mendocino Co., *Davy* 5323; Webber Lake, *Doten* 83; Truckee River, *Davy* 3258; Mt. Tallac, *Hitchcock* 3153; Mt. Hamilton, *Davy;* Mariposa Co., *Congdon;* Sequoia Nat. Park, *Hitchcock* 3387.

Var. **intonsa** Piper. Leaves softly pubescent.—California to Washington. Yreka, *Butler* 1251; Cuyama, *Eastwood* in 1896; Paso Robles, *Grant* 5365.

Refs.—MELICA BELLA Piper, U. S. Dept. Agr. Div. Agrost. Circ. 27: 10. 1900. *M. bulbosa* [Geyer, misapplied by] Vasey U. S. Dept. Agr. Div. Bot. Bull. 13[2]: pl. 63. 1893 (the earliest description). Var. INTONSA Piper, Contr. Nat. Herb. 11: 128. 1906.

7. **M. fugax** Boland. Culms 1 to 2 feet high, bulbous at base; sheaths and blades smooth; panicle narrow, open, the few lower branches 1 to 2 inches long, stiffly spreading, few-flowered; spikelets about 3 lines long, 2 or 3-flowered, usually purple-tinged; glumes broad, papery, the second nearly as long as spikelet; lemmas obscurely nerved, obtuse or emarginate, awnless.

Dry hills, northern California to Washington. Yreka, *Butler* 824; without locality, *Lemmon* in 1875. These specimens belong to the var. madophylla Piper, differing from the species in being smooth.

Refs.—MELICA FUGAX Boland. Proc. Cal. Acad. 4: 104. 1870, 2 specimens cited, Donner Lake, and Lake Tahoe; Thurb. in Wats. Bot. Cal. 2: 304. 1880. Var. *madophylla* Piper, Contr. Nat. Herb. 11: 128. 1906.

8. **M. inflata** Vasey. Culms 2 to 3 feet high, bulbous at base; panicle more or less open, the few branches long, spreading at least in anthesis; spikelets several-flowered, ½ inch long, broad, pale green; glumes broad, shorter than the lemmas, scabrous on the strong nerves; lemmas scabrous, strongly nerved.

Wet meadows, only known from California. Mt. Shasta, *Lemmon* 5448; Yosemite Nat. Park, Hog Ranch, *Hall & Babcock* 3334.

Refs.—Melica inflata Vasey, Contr. Nat. Herb. 1: 269. 1893. *M. poacoides* Nutt. var. *inflata* Boland. Proc. Cal. Acad. 4: 101. 1870, type from Yosemite Valley, *Bolander* 6121. Mentioned under *M. bulbosa* Geyer, by Thurber (Wats. Bot. Cal. 2: 304. 1880).

9. **M. stricta** Boland. Culms ½ to 1½ feet high, the base somewhat thickened but not bulbous; panicle narrow, few-flowered, nearly simple, usually 1 or 2 branches below; spikelets large, about ½ inch long, reflexed on rather delicate pedicels; glumes nearly as long as spikelet, longer than the lower lemma; lemmas scabrous, obtuse, awnless.

Rocky slopes and banks, Eagle Lake (*Jones*) through the Sierra Nevada to Sequoia Nat. Park (*Hall & Babcock* 5684) and Coso Mts. (*Coville & Funston* 936), and in the Coast Ranges (Mt. Pinos, Kern Co., *Hall* 6404) to San Bernardino Mts. (*Parish Bros.* 1553); north into Oregon and east to Utah.

Refs.—Melica stricta Boland. Proc. Cal. Acad. 3: 4. 1863; op. cit. 4: 104. 1872; Thurb. in Wats. Bot. Cal. 2: 303. 1880.

10. **M. frutescens** Scribn. Culms 2 to 6 feet high, rather woody below, not bulbous at base; blades short, especially on the branches and innovations; panicle silvery-shining, narrow, the branches short and appressed; spikelets about ½ inch long; glumes about as long as the spikelet, prominently 5-nerved; lemmas acute, entire, awnless, 7-nerved.

Southern California to Lower California.

Locs.—Panamint Cañon, *Hall & Chandler* 7031; Riverside, *Griffiths* 7851; San Jacinto, *Jones* 3554; Masons, *Brandegee* 135 in 1896; Bernardo, *Abrams* 3361; San Diego Co., *Mearns* 3033.

Refs.—Melica frutescens Scribn. Proc. Acad. Phila. 1885: 45. 1885, type locality, vicinity of San Diego, several specimens cited, the first being *Parry & Lemmon* 401.

11. **M. bulbosa** Geyer. Culms 2 to 4 feet high, the base usually decumbent and often more or less bulbous or corm-like; lower sheaths on the older culms persistent, brown and split into numerous fibers; panicle narrow, rather densely flowered, 4 to 8 inches long, tawny or purplish, not silvery shining; spikelets 5 to 6 lines long, papery, 3 or 4-flowered; second glume about 3½ lines long; lemmas rather prominently 7-nerved, awnless.

Mountain meadows and rocky woods, Ventura Co. north to Oregon and Nevada. The following specimens are softly pubescent: Northfork, *Griffiths* 4415; Yosemite Valley, *Chase* 5712; Tehachapi, *Chase* 5734.

Refs.—Melica bulbosa Geyer; Thurb. in Wats. Bot. Cal. 2: 304. 1800. *M. californica* Scribn. Proc. Acad. Phila. 1885: 46. 1885; Davy in Jepson, Fl. W. Mid. Cal. 62. 1901. *M. poacoides* [Nutt. misapplied by] Torr. U. S. Rep. Expl. Miss. Pacif. 4: 157. 1857; Boland. Proc. Cal. Acad. 4: 101. 1870. (*M. bulbosa* Geyer in Hook. Jour. Bot. & Kew Misc. 8: 19. 1856, and in Gray, Proc. Am. Acad. 8: 409. 1872, are both nomina nuda. See also U. S. Dept. Agr. Div. Agrost. Circ. 27: 10. 1900.) *M. longiligula* Scribn. & Kearn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 225. f. 521. 1899, type *Parish Bros.* 865.

12. **M. torreyana** Scribn. Culms from a loose and decumbent base, 1 to 3 feet high, not bulbous; blades flat, lax; panicle narrow, rather loose, the branches more or less fascicled, appressed or ascending, the lower fascicles distant; spikelets 2 to 3 lines long, with 1 or 2 perfect florets and a rudiment; glumes strongly nerved, nearly as long as spikelet; lemmas pubescent; rudiment long-pediceled, obovoid-truncate, divergent.

Thickets and banks at low altitudes, central California, especially in the Bay region.

Locs.—Mendocino Co., *McMurphy* 422; Butte Co., *Heller* 5511; Sacramento, *Michener* 154; Mariposa Co., *Congdon;* various localities in the Bay region from Mt. Tamalpais to Santa Cruz, *Baker* 2815, *Bolander* 1539, 6076, *Davy* 4257, 7857, *Heller* 5084, 8397, *Hitchcock* 2668, *Palmer* 2046, *Piper* 6304, 6339, *Rutter* 97.

Refs.—MELICA TORREYANA Scribn. Proc. Acad. Phila. 1885: 43. 1885, type appears to be *Torrey* 586 from New Almaden, *Bolander* 6076 also mentioned; Davy in Jepson, Fl. W. Mid. Cal. 62. 1901.

13. **M. imperfecta** Trin. Culms erect, 1 to 3 feet high; blades narrow, usually not over 1 line wide; panicle narrow, from a few inches to a foot in length, the branches more or less fascicled, long and short together; spikelets 2 to 3 lines long, purple-tinged, usually with 1 perfect floret and a rudiment; glumes indistinctly nerved; lemma a little longer than the glumes, smooth, indistinctly nerved, obtuse; rudiment oblong, short-pediceled, appressed to the palea.

Dry open woods and rocky hillsides, Coast Ranges from the Bay region south into Lower California. Two specimens come from further inland, mouth of Kern Cañon, *Heller* 7652, and Dunlap to Millwood, *Griffiths* 4665. The following specimens have larger spikelets: *Abrams* 1220, *Jones* 3092 (one specimen), *Parish Bros.* 885, *Wilder* 1079. Reed's no. 938 from Box Spring Mt., provisionally referred to this species, differs in having a narrow shining interrupted spike-like panicle, the branchlets and pedicels villous; the spikelets having 1 perfect floret.

Var. **refracta** Thurb. Differs in having pubescent blades and spreading or reflexed lower branches of the panicle.—Gravelly brushy slopes, southern California and Lower California.

Locs.—Mt. Pinos, *Hall* 6736; Tehachapi, *Chase* 5738; Mt. Wilson, *Chase* 5573; Los Angeles, *Elmer* 3646; San Gabriel Forest Res., *Leiberg* 3362; Erskine Creek, *Purpus* 5078, 5078a; Santa Cruz Island, *Brandegee* 64 in 1888.

Var. **flexuosa** Boland. Blades glabrous; lower panicle branches spreading or reflexed.—Wooded hillsides and rocky banks, central and southern California.

Locs.—Mariposa Creek, *Congdon;* Yosemite Valley, *Chase* 5696; Northfork, *Griffiths* 4586; Pacific Grove, *Hitchcock* 2620; Laguna, *Schoenfeldt* 3607, 3662; Jacumba Hot Springs, *Schoenfeldt* 3233; various localities from Santa Barbara to San Diego, *Abrams* 1346, 3343, *Baker* 4198, *Hall* 2079, *Leiberg* 3219.

Var. **minor** Scribn. Blades glabrous, very narrow; plant low, less than 1 foot high, a scarcely distinct variety.—Dry hillsides and crevices of rocks, southern California and Lower California.

Locs.—Loma Prieta, *Davy* 426, 568; Nacimiento River, *Davy* 7645; Sequoia Nat. Park, *Davidson* 2105; Ft. Tejon, *Parish* 1997; Mt. Wilson, *Grant* 6244; Colorado Desert, *Mearns* 2976; between Campo and Jacumba, *Abrams* 3630; Santa Catalina Island, *Trask*.

Refs.—MELICA IMPERFECTA Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 2': 59. 1836, type locality California, no specimen mentioned; the type in the Trinius Herbarium is labeled, "Nova California, Douglas, 1833"; Thurb. in Wats. Bot. Cal. 2: 303. 1880; Davy in Jepson, Fl. W. Mid. Cal. 61. 1901; Abrams, Fl. Los Ang. 46. 1904. *M. panicoides* Nutt. Jour. Acad. Phila. II. 1: 188. 1848, type from Santa Barbara, *Gambel*. Var. REFRACTA Thurb. in Wats. Bot. Cal. 2: 303. 1880, type from San Bernardino, *Lemmon;* Abrams, Fl. Los Ang. 47. 1904. Var. *pubens* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 30: 8. 1901, type from Santa Cruz Island, *Brandegee* 64 in 1888. Var. FLEXUOSA Boland. Proc. Cal. Acad. 4: 101. 1870, type locality, "Mariposa to Clark's"; Thurb. in Wats. Bot. Cal. 2: 303. 1880; Abrams, Fl. Los Ang. 46. 1904. Var. MINOR Scribn. Proc. Acad. Phila. 1885: 42. 1885, type from San Bernardino Mts., *Parish Bros.* 856; Abrams, Fl. Los Ang. 46. 1904. *M. poaeoides* Nutt. Jour. Acad. Phila. II. 1: 188. 1848, type said to be from "Island of Santa Catalina", *Gambel*. Through the kindness of Dr. A. B. Rendle, of the Herbarium of the British Museum, I have been able to examine the type specimen of *M. poaeoides* Nutt. It is a good match for Brandegee's no. 114 from La Jolla, collected April 17, 1894. The label accompanying the type specimen gives as the locality, "St. Diego." *M. parishii* Vasey; Beal, Grasses N. Am. 2: 500. 1896, type *Parish* 1997.

53. **PLEUROPOGON** R. Br.

Spikelets many-flowered, linear, in loose racemes. Glumes unequal, membranaceous or subhyaline, 1-nerved or the second imperfectly 3-nerved, shorter than the lemmas. Lemmas membranaceous, 7-nerved, forming a round indurated callus at base, entire or somewhat 2-toothed at the apex, with the midnerve extending into a short mucro or awn. Palea 2-keeled, the keels winged or appendaged. Soft annuals or perennials with flat blades and rather large spikelets.—Species 3, 2 in the U. S. and 1 in the Arctic regions. (Greek pleura, side, and pogon, beard.)

Lemmas about 3 lines long, scabrous and strongly nerved; spikelets not refracted; culm usually not over 2 feet tall.....1. *P. californicus.*
Lemmas about 4 lines long, smooth or slightly scabrous; spikelets often refracted; culms usually over 3 feet high.....2. *P. refractus.*

1. **P. californicus** Benth. Annual; culms 1 to 2 feet high; blades short, abruptly narrowed at apex; racemes 6 to 8 inches long; spikelets distant, about an inch long, erect or somewhat spreading, short-pediceled; glumes obtuse, erose at apex, the first 2 lines, the second 3 lines long; lemmas rather distant, 3 lines long, scabrous, toothed and scarious at apex, the nerves prominent; the awn variable, usually 3 to 6 lines long, sometimes wanting; wings of palea prominent, cleft to form a tooth about the middle.

Wet meadows and marshy ground, Mendocino Co. to the San Francisco Bay region.

Locs.—Sherwood Valley, *Davy* 5129; Santa Rosa, *Heller* 5294; Petaluma, *Piper* 6319; San Rafael, *Blankinship* 19; Marin Co., *Michener & Bioletti* 122; Walnut Creek, *Brewer* 1043; Oakland, *Bolander* 1545, 6075; San Bruno Hills, *Elmer* 4848.

Refs.—Pleuropogon californicus Benth; Vasey, Grasses U. S. 40. 1883; U. S. Dept. Agr. Div. Bot. Bull. 13²: pl. 68. 1893; Davy in Jepson, Fl. W. Mid. Cal. 63. 1901. *Lophochlaena californica* Nees, in Tayl. Ann. Nat. Hist. 1: 283. 1838, type from "California," *Douglas;* Thurb. in Wats. Bot. Cal. 2: 306. 1880.

2. **P. refractus** Benth. Perennial; culms 3 to 5 feet high; spikelets about as in P. californicus, spreading, or often reflexed; lemmas 4 lines long, only minutely scabrous, the nerves less prominent; awn variable, as much as ½ inch long or nearly wanting; palea narrow, keeled to about the middle.

Bogs, wet meadows and mountain streams, Mendocino and Humboldt cos. to Washington.

Locs.—Humboldt Bay, *Chandler* 1107; Russian Gulch, *Davy* 6586; Comptche, *McMurphy* 455; Cahto, *Davy* 6626.

Refs.—Pleuropogon refractus Benth.; Vasey, Grasses U. S. 40. 1883; U. S. Dept. Agr. Div. Bot. Bull. 13²: 69. 1893. *Lophochlaena refracta* Gray, Proc. Am. Acad. 8: 409. 1872; Thurb. in Wats. Bot. Cal. 2: 307. 1880.

54. **DISTICHLIS** Raf.

Spikelets many-flowered, dioecious, strongly compressed, in small panicles. Glumes unequal, firm, keeled, acute. Lemmas coriaceous, rigid, faintly many-nerved. Rigid erect perennials, with stout rhizomes, and dense panicles of rather few spikelets.—Species about 5, salt marshes and alkaline interior plains, temperate America. (Greek distichos, two-ranked.)

1. **D. spicata** Greene. Pale or glaucous; culms 4 inches to 2 feet high; sheaths overlapping; blades often conspicuously distichous, rigidly ascending; panicle narrow, 1 to 3 inches long; spikelets 4 to 8 lines long, the florets closely imbricated.

Salt marshes and alkaline soil; common in California along the coast and the

interior deserts and valleys; not found at high altitudes. Throughout the U. S. and Mexico.

Refs.—DISTICHLIS SPICATA Greene, Bull. Cal. Acad. 2: 415. 1887; Davy in Jepson, Fl. W. Mid. Cal. 63. 1901; Abrams, Fl. Los Ang. 47. 1904. *Uniola spicata* L. Sp. Pl. 71. 1753. *Distichlis maritima* Raf. Jour. de Phys. 89: 104. 1819; Thurb. in Wats. Bot. Cal. 2: 306. 1880. Var. *stricta* Thurb. in Wats. Bot. Cal. 2: 306. 1880. *Uniola stricta* Torr. Ann. Lyc. N. Y. 1: 155. 1824.

55. BRIZA L.

Spikelets several-flowered, compressed, rounded-ovate or triangular, in panicles. Glumes membranaceous, with broad scarious margins, strongly concave, rounded on the back and more or less ventricose. Lemmas similar, 3 to many-nerved, nearly horizontal to the axis. Annuals or perennials, the California species with open panicles of handsome spikelets.—Species 12, in the temperate regions of Europe, North Africa, Mexico and South America, and certain species introduced into the U. S. (An ancient Greek name for a kind of grain, probably rye.)

Plants perennial ..... 1. *B. media.*
Plants annual.
Panicle drooping; spikelets 5 lines broad ..... 2. *B. maxima.*
Panicle erect; spikelets not over 2 lines broad ..... 3. *B. minor.*

1. **B. media** L. Perennial; culms erect, 1 to 2 feet high, erect or decumbent at base; panicle erect, pyramidal, many-flowered, the branches capillary, stiffly ascending or spreading; spikelets nodding, 3 lines long, heart-shaped, or triangular-ovate.

Sparingly introduced from Europe. Bennett Valley, *Heller* 5649.

Refs.—BRIZA MEDIA L. Sp. Pl. 70. 1753; Thurb. in Wats. Bot. Cal. 2: 316. 1880; Davy in Jepson, Fl. W. Mid. Cal. 64. 1901.

2. **B. maxima** L. Annual; culms erect or decumbent at base, 1 to 2 feet high; panicle drooping, few-flowered; spikelets ovate, large, ½ inch long or more, 5 lines broad, the pedicels slender, drooping; glumes and lemmas usually purple- or brown-margined.

A native of Europe, sparingly escaped from gardens where it is cultivated for ornament. Big Snr, *Davy* 7459.

Refs.—BRIZA MAXIMA L. Sp. Pl. 70. 1753; Davy in Jepson, Fl. W. Mid. Cal. 64. 1901.

3. **B. minor** L. Annual; culms erect, 4 to 15 inches high; panicle erect, pyramidal, many-flowered, the main branches stiffly ascending, the capillary branchlets spreading; spikelets triangular-ovate, 1½ lines long.

Naturalized from Europe, rather common from central California to British Columbia.

Refs.—BRIZA MINOR L. Sp. Pl. 70. 1753; Davy in Jepson, Fl. W. Mid. Cal. 64. 1901.

56. DACTYLIS L.

Spikelets 3 to 5-flowered, nearly sessile in dense fascicles, borne in panicles. Glumes unequal, keeled, acute, the first 1-nerved, the second 3-nerved. Lemmas 5-nerved, awn-pointed, compressed-keeled, the keels conspicuously ciliate-fringed. A perennial bunch-grass, with flat blades, and paniculate glomerules, the few branches expanded in flower.—Species 1, north temperate regions of the Old World. (Greek daktulos, a finger.)

1. **D. glomerata** L. ORCHARD GRASS. Culms erect, 2 to 4 feet high; blades broadly linear; panicle 3 to 6 inches long, the few stiff branches naked below, contracted after flowering; spikelets crowded in dense 1-sided clusters at the ends of the branches.

A native of Europe, commonly cultivated in the cooler regions of the U. S. as a meadow grass. Escaped from cultivation along roadsides and in waste places. Yreka, *Butler* 835; Scotia, *Davy & Blasdale* 5957; Bennett Valley, *Heller* 5657; Lake Tahoe, *McGregor* 199; San Bernardino, *Parish*.

Refs.—Dactylis glomerata L. Sp. Pl. 71. 1753; Thurb. in Wats. Bot. Cal. 2: 301. 1880; Davy in Jepson, Fl. W. Mid. Cal. 65. 1901; Abrams, Fl. Los Ang. 48. 1904.

57. **LAMARCKIA** Moench.

Spikelets of 2 forms, in fascicles, the terminal one of each fascicle fertile, the others sterile. Fertile spikelet single, with 1 perfect floret, the rachilla produced beyond the floret into a slender stipe, bearing a small awned empty lemma, or reduced wholly to an awn. Glumes narrow, acuminate, or short-awned, 1-nerved. Lemma broader, 1-nerved, bearing below the apex a slender straight awn. Stamens 3. Sterile spikelets linear, 1 to 3 in each fascicle, consisting of 2 glumes similar to those of the fertile spikelet, and numerous, distichously imbricated, obtuse awnless empty lemmas. A low annual grass with elegant 1-sided narrow panicles of crowded fasciculate spikelets, the fertile spikelets being hidden, except the awns, by the numerous sterile ones.—Species 1, southern Europe, introduced in California. (Jean Baptiste Antoine Pierre Monnet, Chevalier de La Marck, the eminent French naturalist.)

1. **L. aurea** Moench. Golden-top. Culms erect, or decumbent at base, 4 to 15 inches high; leaves smooth; ligule prominent, decurrent as a broad, scarious margin; panicle dense, 1 to 3 inches long, ½ to 1 inch wide, shining, golden-yellow or purplish, the branches close, short, erect; pedicels fascicled, somewhat clavate, pubescent, spreading at right angles, the fascicles with a tuft of long whitish hairs at the base; fertile spikelet about 1 line long, the sterile 3 to 4 lines long; glumes narrow, hyaline, 1 line long; lemmas awned from below the apex.

A native of the Mediterranean region, abundantly naturalized in southern California, rarer northward to Santa Clara Co.; also in northern Mexico.

Refs.—Lamarckia aurea Moench, Meth. Pl. 201. 1794; Thurb. in Wats. Bot. Cal. 2: 299. 1880; Davy in Jepson, Fl. W. Mid. Cal. 65. 1901; Abrams, Fl. Los Ang. 49. 1904. *Cynosurus aureus* L. Sp. Pl. 72. 1753. *Achyrodes aureum* Kuntze, Rev. Gen. Pl. 2: 758. 1891.

58. **POA** L.

Spikelets 2 to several-flowered, the uppermost floret rudimentary, in open or narrow panicles. Glumes keeled, 1 to 3-nerved. Lemmas herbaceous or membranaceous, mostly scarious-tipped, acute or obtuse, keeled, awnless, 5-nerved, the intermediate nerves sometimes obscure, keel and marginal nerves sometimes villous, the floret sometimes with cobwebby hairs at base. Annuals or perennials with blades ending in a navicular point.—Species numerous, over 100, in the temperate and cool regions of both hemispheres. (Greek poa, grass or fodder.)

Plants annual.
  Lemmas villous on nerves below.
    Panicle pyramidal, open; sheaths smooth ..... 1. *P. annua.*
    Panicle narrow, contracted; sheaths scabrous ..... 2. *P. bigelovii.*
  Lemmas not villous on keel and nerves.
    Sheaths rough; lemmas pubescent on back ..... 3. *P. howellii*
    Sheaths smooth; lemmas smooth or nearly so ..... 4. *P. bolanderi.*
Plants perennial.
  Creeping rhizomes present.
    Lemmas not webbed at base.
      Glumes 4 lines long; spikelets about ½ inch long ..... 5. *P. macrantha.*

Glumes 1 to 2 lines long.
Panicles open; glumes 2 lines long....6. *P. olneyae.*
Panicles almost spike-like; glumes 1 line long....7. *P. atropurpurea.*
Lemmas webbed at base, sometimes sparingly so.
Culm conspicuously flattened....8. *P. compressa.*
Culm terete or nearly so.
Lemmas not pilose on keel or nerves.
Panicle contracted; web sparse....9. *P. confinis.*
Panicle open; web abundant....10. *P. kelloggii.*
Lemmas pilose on keel and usually also on marginal nerves.
Panicle dense and spike-like; plants dioecious....11. *P. douglasii.*
Panicle more or less open; plants not dioecious.
Lemmas 1½ lines long....12. *P. pratensis.*
Lemmas 2¼ lines long....13. *P. rhizomata.*
Creeping rhizomes absent.
Lemmas villous on keel and marginal nerves; blades firm, folded.
Ligule 2½ to 3½ lines long, acute....15. *P. longiligula.*
Ligule short, rounded or truncate....14. *P. fendleriana.*
Lemmas sometimes pubescent near base but not villous on keel and marginal nerves.
Lemmas pubescent on lower part.
Blades filiform.
Panicle spike-like....18. *P. nudata.*
Panicle loose and open....19. *P. tenerrima.*
Blades narrow but not filiform.
Sheaths scabrous; panicle usually narrow....16. *P. scabrella.*
Sheaths smooth; panicle usually comparatively short and open.
Blades scattered along culm; culms loose and decumbent at base; spikelets 3 to 4 lines long....20. *P. alcea.*
Blades mostly basal.
Panicle open; culms decumbent at base....21. *P. gracillima.*
Panicle contracted; culms erect....17. *P. sandbergii.*
Lemmas smooth or scaberulous.
Panicle close and spike-like; plants of sea-side cliffs....22. *P. unilateralis.*
Panicle more or less open.
Spikelets 1 or 2-flowered; panicle long, open....23. *P. thurberiana.*
Spikelets 3 to several-flowered.
Blades filiform.
Blades smooth....24. *P. hanseni.*
Blades scabrous....25. *P. idahoensis.*
Blades narrow but not filiform.
Sheaths scabrous; panicle long, narrow....26. *P. nevadensis.*
Sheaths smooth.
Panicle narrow, 4 to 8 inches long; culms 1½ to 3 feet high....27. *P. brachyglossa.*
Panicle short, 1 to 2 inches long; culms lower; blades involute, firm.
Lemmas about 3 lines long....28. *P. pringlei.*
Lemmas 1½ to 2 lines long.
Culms 3 to 8 inches high; blades smooth....29. *P. leibergii.*
Culms 1 to 2 feet high; blades scabrous....30. *P. cottoni.*

1. **P. annua** L. Annual; culms flattened, decumbent at base, sometimes rooting at the lower nodes; sheaths loose; blades soft and lax; panicle pyramidal, open, 1 to 3 inches long; spikelets crowded, 3 to 6-flowered, about 2 lines long; lemma not webbed at base, distinctly 5-nerved, the nerves pilose on lower half.

Open ground, along roadsides and in waste places, throughout the state, except in the deserts; extends from Alaska to Mexico; introduced from Europe.

Refs.—Poa annua L. Sp. Pl. 68. 1753; Thurb. in Wats. Bot. Cal. 2: 311. 1880; Davy in Jepson, Fl. W. Mid. Cal. 66. 1901; Abrams, Fl. Los Ang. 45. 1904. *P. infirma* H. B. K. Nov. Gen. & Sp. 1: 158. 1816; Abrams, Fl. Los Ang. 50. 1904.

2. **P. bigelovii** Vasey & Scribn. Annual; culms erect, 6 to 15 inches high; panicle narrow, 3 to 6 inches long, the branches short, appressed; spikelets ovate, about 3 lines long; glumes acuminate, 3-nerved, 2 lines long; lemmas 2 lines long, webbed at base, copiously pilose on the lower part of the lateral nerves and keel, villous on lower portion of back between.

Open ground, southern California to western Texas, south into Mexico.

Locs.—Panamint Cañon, *Jones;* Los Angeles, *Davidson;* Colorado Desert, Coyote Cañon, *Hall* 2835; Palm Springs, *Parish* 6139; Laguna Mts., *Orcutt.*

Refs.—Poa bigelovii Vasey & Scribn. in Vasey, Cat. Grasses U. S. 81. 1885. *P. annua* L. var. *stricta* Vasey, Bull. Torr. Club 10: 31. 1883.

3. **P. howellii** Vasey & Scribn. Annual; culms 1 to 3 feet high; sheaths retrorsely scabrous; paniele including ⅓ to ½ the plant, open, the branches in rather distant fascicles, spreading, scabrous, naked below, some short branches intermixed; spikelets 1½ to 2 lines long, usually 3 or 4-flowered; glumes narrow, acuminate, the first ¾ line long, 1-nerved or rarely 3-nerved, the second 1 line long, 3-nerved; lemmas webbed at base, 1 line long, ovate, pubescent over the lower ½ or ⅔, the nerves all rather distinct.

Rocky banks and shaded slopes, at moderate altitudes, mostly in the Coast Ranges; north to Vancouver Island. Two specimens from Yosemite Nat. Park (*Congdon, Chase* 5701) differ in having smooth sheaths and more or less 3-nerved first glume, and may prove to be a distinct species.

Refs.—Poa howellii Vasey & Scribn. U. S. Dept. Agr. Div. Bot. Bull. 13²: pl. 78. 1893. Var. *microsperma* Vasey, Contr. Nat. Herb. 1: 273. 1893, type from Santa Cruz, *Anderson* 99.

4. **P. bolanderi** Vasey. Annual; culms erect, 6 inches to 2 feet high; sheaths smooth; paniele open, about ½ the length of the entire plant, the branches few and distant, smooth, stiffly spreading or somewhat reflexed, naked below; spikelets usually 2 or 3-flowered; glumes broad, the first 1-nerved, 1 line long, the second 3-nerved, 1½ lines long; lemma scantily webbed at base, smooth, scabrous on the keel, acute, the marginal nerves rather indistinct, the intermediate nerves obsolete.

Open ground or open woods, confined to the Sierra Nevada and high southern mountains; north to Washington, east to Alberta and Utah.

Locs.—Siskiyou Co., *Butler* 1747, 1750; Truckee Basin, *Davy* 3256; Tahoe, *Hitchcock* 3083; Mt. Tallac, *Hitchcock* 3156; Amador Co., *Hansen* 2081; Yosemite Nat. Park, *Hitchcock* 3255, 3308, 3315; Madera Co., *Congdon;* Bald Hill, *Leiberg* 5062; Pine Ridge, Fresno Co., *Hall & Chandler* 322; Sequoia Nat. Park and vicinity, *Culbertson* 4436, *Hall & Chandler* 432, *Hitchcock* 3367, 3391, 3466; San Jacinto Mts., *Reed* 2486.

Refs.—Poa bolanderi Vasey, Bot. Gaz. 7: 32. 1882, type *Bolander* 6115 (from Ostrander's, Yosemite Park, acc. Bolander's Field Book). Var. *chandleri* Piper, Contr. Nat. Herb. 11: 132. 1906. *P. howellii* Vasey & Scribn. var. *chandleri* Davy, Univ. Cal. Publ. Bot. 1: 60. 1902, type from Schakelford Cañon, Marble Mt., *Chandler* 1703.

5. **P. macrantha** Vasey. Perennial from extensively creeping rhizomes; culms erect from a decumbent base, ½ to 1½ feet high, the sterile shoots widely spreading; sheaths smooth, tawny, and papery; blades smooth, involute, more or less curved or flexuous; paniele narrow, contracted, sometimes dense and spike-like, 2 to 5 inches long, pale or tawny; spikelets large, about ½ inch long, about 5-flowered; glumes smooth, 3-nerved, or the second indistinctly 5-nerved, about 4 lines long; lemmas 4 lines long, not webbed at base, short-pilose on the keel and marginal nerves below, slightly scabrous on

the keel above and sparingly on the back near margins; palea ciliate on keels.

Sand dunes along the coast, northern California to Washington. Crescent City, *Davy & Blasdale* 5966.

Ref.—Poa macrantha Vasey, Bull. Torr. Club 15: 11. 1888.

6. **P. olneyae** Piper. Perennial from creeping rhizomes; culms 1 to 2 feet high; sheaths smooth, or slightly scabrous; ligule about 1 line long; blades flat or folded, smooth on lower surface; panicle pyramidal, rather open, 1 to 4 inches long, the lower branches 2 or 3 in a cluster, about an inch long, ascending or spreading; glumes 2 lines long, acute; lemmas nearly smooth, sparingly pubescent or scaberulons on keel and marginal nerves, not webbed, the intermediate nerves faint.

Alpine meadows, open woods, and rocky banks in the Sierra Nevada and high southern mountains; north to British Columbia and east to Montana.

Locs.—Siskiyou Co., *Butler* 1318; Bierstadt Peak, *Davy* 3228 in part; Webber Lake, *Kennedy & Doten* 137; Truckee River, *Sonne* 4; Yosemite Nat. Park, *Hall & Babcock* 3538, 3567, *Hitchcock* 3278, 3319; Black Mts., *Hall & Chandler* 610; Sequoia Nat. Park, *Davidson* 2109, *Hitchcock* 3438; Griffin, Ventura Co., *Elmer* 3970; San Jacinto Mts., *Reed* 2496, *Wilder* 913; Fallbrook, *Jones* 3096.

Ref.—Poa olneyae Piper, Erythea 7: 101. 1899.

7. **P. atropurpurea** Scribn. Perennial from creeping rhizomes; culms 1 to 1½ feet high, slender; sheaths smooth; blades mostly basal, folded or involute, firm, smooth on under surface, the uppermost culm-leaf below the middle; panicle narrow, contracted, almost spike-like, purple-tinged, 1 to 2 inches long; spikelets 1½ to 2 lines long, turgid; glumes broad, less than 1 line long; lemmas a little over 1 line long, broad, smooth, not webbed, the nerves faint.

Only known from the San Bernardino Mts., *Parish* 2477, 2968, 3696.

Ref.—Poa atropurpurea Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 53. pl. 10. 1898, type *Parish* 2968.

8. **P. compressa** L. Canada Bluegrass. Perennial from creeping rhizomes; culms not tufted, geniculate-ascending, flattened, wiry, bluish green, ½ to 1½ feet high; panicle narrow, 1 to 3 inches long, the usually short branches in pairs, spikelet-bearing to the base; spikelets crowded, subsessile, 3 to 6-flowered, 2 to 3 lines long; glumes about 1 line long, 3-nerved; lemmas firm, obscurely nerved, 1 to 1¼ lines long, sparingly webbed at base, short-pubescent below on keel and marginal nerves.

Open ground, open woods, meadows and waste places throughout the U. S., introduced from Europe.—Distinguished from P. pratensis in gross appearance by the color and the scattered culms.

Ref.—Poa compressa L. Sp. Pl. 69. 1753.

9. **P. confinis** Vasey. Perennial from creeping rhizomes; culms low, often geniculate or ascending at base, usually less than 6 inches high; sheaths and involute blades smooth; panicle narrow, contracted, ½ to 1 inch long, tawny; spikelets about 2 lines long; glumes unequal, the second 1½ lines long; lemmas 1½ lines long, scaberulous, sparsely webbed at base, the nerves faint.

Sand dunes and sandy meadows near the coast, Mendocino Co. (*Congdon*) to Alaska.

Ref.—Poa confinis Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13²: pl. 75. 1893.

10. **P. kelloggii** Vasey. Perennial from creeping rhizomes; culms 1 to 2 feet high, smooth, sheaths smooth, mostly basal; blades flat or folded, scabrous on upper surface; panicle pyramidal, open, 3 to 6 inches long, the branches mostly in 1's or 2's, slender, spreading or reflexed, bearing a few

spikelets toward the extremities; spikelets rather loosely flowered, 2 to 3 lines long; glumes 1 and 1½ lines long; lemmas acute or almost cuspidate, 1½ to 2 lines long, smooth, rather obscurely nerved, conspicuously webbed at base.

Coast Ranges from Humboldt Co. to Santa Cruz Co.

Locs.—Humboldt Bay, *Chandler* 1183; Mendocino, *Brown* 763; Comptche, *McMurphy* 476; Russian Gulch, *Davy* 6584; Santa Cruz Co., *Elmer* 5029.

Ref.—Poa kelloggii Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13[2]: pl. 79. 1893, type *Bolander* 4705 (from Mendocino Co. acc. Bolander's Field Book).

11. **P. douglasii** Nees. Perennial from extensively creeping rhizomes; culms ascending from a decumbent base, usually less than a foot high; sheaths smooth, tawny and papery; blades involute, some of these usually exceeding the culm; panicles dioecious, ovoid or oblong, dense and spike-like, 1 to 2 inches long, ¾ inch wide, pale or tawny; spikelets 3 to 5 lines long, about 5-flowered; glumes broad, 3-nerved, smooth, scabrous on upper part of keel, nearly equal, 2 to 3 lines long; lemmas 3 lines long, slightly webbed at base, villous on the lower part of keel and marginal nerves, scabrous on keel above, 1 to 3 pairs of indistinct intermediate nerves; palea ciliate on keels.

Sand dunes near the coast, Pt. Arena to Monterey.

Locs.—Pt. Arena, *Davy & Blasdale* 6045; Bodega Bay, *Heller* 5187; Pt. Reyes, *Davy* 6742; San Francisco, *Bolander* 1528, 6074, *Piper* 6223; Oakland, *Jones* 3258; Santa Cruz, *Anderson;* Monterey and vicinity, *Chase* 5655, *Davy* 7291, *Hitchcock* 2596.

Refs.—Poa douglasii Nees, Ann. Nat. Hist. 1: 284. 1838; Thurb. in Wats. Bot. Cal. 2: 314. 1880; Davy in Jepson, Fl. W. Mid. Cal. 66. 1901.

12. **P. pratensis** L. Kentucky Bluegrass. Perennial from creeping rhizomes; culms tufted, 1 to 3 feet high, terete or slightly flattened; sheaths smooth, compressed; ligule about 1 line long; blades soft, flat or folded, the basal often elongated; panicle pyramidal, open, the slender branches in remote fascicles of 3 to 5, ascending or spreading, naked at base, some of them short; spikelets crowded, 3 to 5-flowered, 2 to 2½ lines long; lemmas 1½ lines long, copiously webbed at base, silky-pubescent on the keel and marginal nerves, the intermediate nerves prominent.

Open woods, banks, open ground, except in the deserts; extends throughout the northern part of North America and Eurasia; extensively cultivated as a pasture and lawn grass. Some forms are clearly native in the mountains, while other forms, especially at low altitudes are escaped from cultivation.

Refs.—Poa pratensis L. Sp. Pl. 67. 1753; Thurb. in Wats. Bot. Cal. 2: 312. 1880; Davy in Jepson, Fl. W. Mid. Cal. 66. 1901; Abrams, Fl. Los Ang. 50. 1904.

P. trivialis L. is mentioned by Thurber (Wats. Bot. Cal. 2: 313. 1880) as being introduced along the Coast Ranges.

13. **P. rhizomata** Hitchc. n. sp. Perennial from creeping rhizomes; culms erect, 1 to 2 feet high, smooth; sheaths smooth, the lower loose and papery; ligule 1 to 1½ lines long; blades flat or folded, ½ to 1 line wide, 1 to 3 inches long, the culm blades about 2, the upper erect, about 1 inch long; panicle long-exserted, oblong, contracted, 1 to 2 inches long, the branches short, slender, mostly in 2's, ascending, few-flowered; spikelets about 3 lines long, 3 to 5-flowered; glumes unequal, rather broad, acute, scabrous on the keels, the first 1-nerved, 1½ lines long, the second 3-nerved, 2 lines long; lemmas 2½ lines long, acutish, copiously webbed at base, short-pilose on keel below, and sparingly so on lower part of marginal nerves, the intermediate nerves faint, sparingly scabrous between the nerves; palea ciliate on the keels.—(Perennis e rhizomatibus repentibus; culmi recti, 1-2 ped. alti, glabri; vaginae glabrae;

ligula 1-1½ lin. longa; laminae planae vel conduplicatae, ½-1 lin. latae, 1-3 pol. longae, caulinae plerumque 2; panicula oblonga, coarctata, 1-2 pol. longa, ramis brevibus, tenuibus, ascendentibus, paucifloris; spiculae circa 3 lin. longae, 3-5 florae; glumae inaequales, latisculae, acutae, carinis scabrae, prima 1-nervia, 1½ lin. longa, altera 3-nervia, 2 lin. lata; lemmata 2½ lin. longa, subacuta, basi valde villosa inter nervos scabra, carina nervisque marginalibus prope basin breviter pilosis, nervis intermediis obscuris; palea carinis ciliatis.)

Type specimen, *Butler* 1205, Oro Fino, Siskiyou Co., in damp shady woods, Apr. 21, 1910. The only other specimens seen from California are *Butler* 1206 from Siskiyou Co., and *Hatton* 43 from Modoc National Forest. The species also occurs in Idaho (Beaver Cañon, *Shear* 297). The above description is drawn from the type specimen in the National Herbarium.

14. **P. fendleriana** Vasey. Tufted perennial; culms erect, smooth, scabrous below panicle, 1 to 1½ feet high; sheaths somewhat scabrous; ligule less than ½ line long; blades mostly basal, involute or folded, scabrous, firm; panicle long-exserted, narrow, contracted, 1 to 3 inches long; glumes broad, 1½ lines long, the first 1-nerved; lemmas 2 lines long, long-pilose on the lower portion of keel and marginal nerves, the intermediate nerves obscure.

Mesas and hills, Great Basin from Washington to Wyoming, south to New Mexico and southern California. Panamint, *Hall & Chandler* 7009; San Bernardino Mts., *Parish* 3307.

Refs.—Poa fendleriana Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13²: pl. 74. 1893; Williams, U. S. Dept. Agr. Div. Agrost. Circ. 10: 5, 1899; Abrams, Fl. Los Ang. 50. 1904. *Eragrostis fendleriana* Steud. Syn. Pl. Glum. 1: 278. 1854. *Atropis californica* Munro; Thurb. in Wats. Bot. Cal. 2: 309. 1880.

15. **P. longiligula** Scribn. & Williams. Tufted perennial, similar to P. fendleriana; culms smooth, 1 to 2 feet high; sheaths and blades smooth; ligule 2½ to 3½ lines long, or on the innovations somewhat shorter; panicle looser and often longer; spikelets as in P. fendleriana.

Cañons and banks of streams, San Bernardino Mts. and from Montana to New Mexico. San Bernardino Mts., *Parish* 5043, 5045; Mt. Davidson, *Bloomer* 2269; Grayback Mt., *Reed* 2768.

Refs.—Poa longiligula Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 3. 1899; Williams, U. S. Dept. Agr. Div. Agrost. Circ. 10: 3. 1899.

16. **P. scabrella** Benth. Tufted perennial; culms erect, 2 to 3 feet high, usually scabrous, at least below panicle; sheaths scabrous; ligule rather long; blades mostly basal, flat, narrow, usually about ½ line wide, lax, more or less scabrous; panicle narrow, usually contracted, sometimes rather open at base, 2 to 5 inches long; spikelets narrow, 3 to 5 lines long; glumes scabrous, 1½ lines long; lemmas 2 lines long, puberulent or scabrous on back, and more or less crisp-pubescent at base.

A common species throughout the state in meadows, woods, rocks and hills, and extending into Oregon, Nevada, Arizona and Mexico. As here limited the species includes a number of rather diverse forms which with our present knowledge can not be satisfactorily separated into distinct species. The following are some of the numbered specimens referred to this species: *Abrams* 1162, 1475, 3105, *Bolander* 1547, 1550, *Brewer* 233, 1024, 1122, *Davy* 6650, *Hall* 1439, 1661, 2064, 2973, 2974, 3089, 6360, 7811, *Heller* 5245, 5249, 7584, 8007, 8038, 8188, 8267, 8304, 8706, *Hitchcock* 2725, 3320, 3328, 3329, *Jepson* 4241, *Parish* 1548, 3304, 3348, 5044, *Parish Bros.*, 1641. The following have an unusually open panicle: Santa Barbara, *Elmer* 4153; Ventura, *Hubby* 25.

Refs.—Poa scabrella Benth.; Vasey, Grasses U. S. 42. 1883; Abrams, Fl. Los Ang. 51. 1904. *Atropis scabrella* Thurb. in Wats. Bot. Cal. 2: 310. 1880, type from Oakland, *Bolander*. *Poa orcuttiana* Vasey, W. Am. Sci. 3: 165. 1887, type from San Diego, *Orcutt*. *P. limosa* Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 5. 1899, type from Mono Lake, *Bolander*. The species of this group require careful monographic study. *Poa secunda* Presl (Rel. Haenk. 1: 271. 1830), from Chile appears to belong to this species, and, if so, the name must be taken up as has been done by Davy (Jepson, Fl. W. Mid. Cal. 67. 1901. See also, Scribn. Rep. Mo. Bot. Gard. 10: 51. pl. 51. 1899). *P. buckleyana* Nash (Bull. Torr. Club 22: 465. 1895; *P. tenuifolia* Buckl. Proc. Acad. Phila. 1862: 96. 1863, not A. Rich. 1851) is probably also a synonym.

17. **P. sandbergii** Vasey. Similar to P. scabrella; differing in being smooth, averaging lower and more slender, the panicle smaller, the blades short and soft, often involute.

Plains and dry or rocky woods from Ventura and San Bernardino cos. north to British Columbia and east to Wyoming. Specimens intermediate between this species and P. scabrella occur.

Refs.—Poa sandbergii Vasey, Contr. Nat. Herb. 1: 276. 1893. *Atropis tenuifolia* Thurb. in Wats. Bot. Cal. 2: 310. 1880, mainly as to description but the name is based on *Poa tenuifolia* Buckl.

18. **P. nudata** Scribn. Differs from P. scabrella in having a close and spike-like panicle, nearly naked culms, and capillary blades.

Only known from the type specimen, collected at Potrero, San Diego Co., in 1892, the collector unknown.

Refs.—Poa nudata Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 9: 1. 1899. *P. capillaris* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 51. 1898, not L., type from Potrero.

19. **P. tenerrima** Scribn. Differs from P. scabrella in having a much more open panicle, with spreading branches; blades capillary; ligule short.—Known only from the type specimen, which was sent to Prof. Scribner from the California Academy of Sciences, without data as to locality or collector.

Ref.—Poa tenerrima Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 9: 4. 1899.

20. **P. alcea** Piper. Tufted perennial; culms slender, 2 to 3 feet high, loose and decumbent at base; sheaths smooth or somewhat scabrous, loose and papery at base; ligule long; blades flat, rather soft, more or less scabrous; panicle loose and open, the branches 1 to 2 inches long, ascending; spikelets 3 to 4 lines long, tawny; glumes smooth, the second 2 lines long; lemmas about 2 lines long, puberulent at base, the nerves not prominent.

Wet rocks and rocky banks, Mendocino Co. (Sherwood, *Hitchcock* 2714); also in Oregon. A specimen from Palm Springs (*Parish* 6141) is tentatively referred to this species but it is far out of the known range.

Ref.—Poa alcea Piper, Bull. Torr. Club 32: 436. 1905.

21. **P. gracillima** Vasey. Tufted perennial; culms 1 to 2 feet high, erect from usually a decumbent base; sheaths smooth; ligule 1½ lines long; blades flat or folded, lax, smooth, mostly basal; panicle pyramidal, loose, rather open, 2 to 4 inches long, the branches in whorls, the lower 2 to 6, 1 to 3 inches long, slender, spreading or sometimes reflexed, naked below; spikelets 2 to 3 lines long; glumes smooth, the second 1½ to 2 lines long; lemmas about as long as second glume, minutely scabrous, crisp-pubescent near base, especially on the nerves.

Rocky woods or gravelly soil, in the Sierra Nevada from Nevada Co. (*Torrey* 572) to Sequoia Nat. Park (*Hall & Babcock* 5540); Oregon to British Columbia. Two specimens with smooth lemmas are referred here, Nacimiento River, Monterey Co., *Davy* 7673 and Ebbetts Pass, *Brewer* 2077. The former is out of range and may belong to a different species.

Refs.—Poa gracillima Vasey, Contr. Nat. Herb. 1: 272. 1893. *P. invaginata* Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 6. 1899, type from "Summit Camp, Sierra Nevada, July 10, 1870."

22. **P. unilateralis** Scribn. Tufted perennial; culms 4 to 15 inches high; sheaths smooth, tawny and papery; blades flat or folded, shorter than the culms; panicle oblong, dense and spike-like, or somewhat interrupted below, 1 to 3 inches long; spikelets 3 to 4 lines long, perfect; glumes broad, acute, smooth, indistinctly scabrous on keel near apex, the first 1-nerved or indistinctly 3-nerved, the second 3-nerved; lemmas 2 lines long, not webbed at base or pilose, scabrous on base of marginal nerves and apex of keel, the intermediate nerves faint; palea ciliate on keels.

Cliffs, bluffs and rocky meadows near the seashore, Humboldt Co. to Monterey.

Locs.—Humboldt Bay, *Chandler* 1140; Mendocino, *McMurphy* 399; Pt. Arena, *Davy & Blasdale* 6024; Bodega Bay, *Heller* 5279; Pt. Reyes, *Davy* 6765, 6804, 6881; San Francisco, *Abrams* 1599; Montara Pt., *Copeland* 3306; Santa Cruz, *Anderson;* Monterey and vicinity, *Davy* 7293, *Heller* 6702.

Refs.—Poa unilateralis Scribn.; Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13[2]: pl. 85. 1893, type from San Francisco, *Jones* 15 in 1882; Davy in Jepson, Fl. W. Mid. Cal. 67. 1901. *Atropis procumbens* Thurb. in Wats. Bot. Cal. 2: 309. 1880. This name is based on *Poa procumbens* Curt. but the specimen in the Gray Herbarium (*Bolander* 6467, seashore at Fort Bragg, Mendocino Co.) cited by Thurber, consists mostly of *Poa unilateralis* and this is the species described. But mounted with this is a fragment of *Sclerochloa procumbens* Beauv. It is not impossible that this fragment may have been detached from a European specimen by Dr. Thurber, for comparison with the Bolander specimen and not afterwards removed. *Sclerochloa procumbens* is not known to grow on the Pacific Coast.

23. **P. thurberiana** Vasey. Tufted perennial; culms 2 to 3 feet high, smooth; sheaths somewhat scabrous, the basal smooth and papery; ligule 1 to 2 lines long; blades narrow, involute, scabrous; panicle narrow, 8 to 10 inches long, loose, the branches long, ascending; spikelets 2 lines long, 1 or 2-flowered; glumes 1½ lines long, 3-nerved; lemmas 1½ lines long, scaberulous, not pilose or webbed.

Little known. Aside from the type collection by Lemmon, in Sierra Valley, this species was collected by Bolander (Los Angeles?) and what appears to be the same species by Chase at Santa Barbara (no. 5604).

Refs.—Poa thurberiana Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13[2]: pl. 84. 1893. *Paniculuria thurberiana* Kuntze, Rev. Gen. Pl. 2: 783. 1891. *Atropis pauciflora* Thurb. in Wats. Bot. Cal. 2: 310. 1880 (type from Sierra Valley, *Lemmon*), not *Poa pauciflora* Roem. & Schult. 1817.

24. **P. hanseni** Scribn. Tufted perennial; culms erect, slender, 6 to 8 inches high or sometimes taller, smooth; sheaths smooth; ligule ½ to 1 line long; blades capillary, involute, smooth, mostly basal; panicle narrow, 1 to 2 inches long; spikelets 2 to 3 lines long; glumes 1½ to 2 lines long; lemmas scaberulous but not pilose or webbed.—Differs from P. pringlei in being more delicate and in having smaller spikelets.

A little known species from isolated localities in California. Modoc Nat. For., *Hatton* 63; Plumas Co., *Heller* 8751; Tuolumne Meadows, *Hall & Babcock* 3627 in part; Loma Prieta, *Davy* 534.

Ref.—Poa hanseni Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 53, pl. 9. 1898, type from Silver Lake, Amador Co., *Hansen* 605.

25. **P. idahoensis** Beal. Tufted perennial; culms slender, 6 to 18 inches high, smooth, slightly scabrous below the panicle; sheaths loose and papery, smooth; blades capillary, soft, scabrous, the basal as much as 10 inches long; panicle narrow, contracted but loose, 1 to 2 inches long; spikelets 2½ to 3 lines

long; glumes broad, scarious-margined, about 1½ lines long; lemmas about 2 lines long, minutely scabrous, not webbed at base or pilose.

Washington to Idaho and California. The only specimen observed from California is *Hansen* no. 2614, without locality but probably Amador Co.

Refs.—Poa idahoensis Beal, Grasses N. Am. 2: 539. 1896. *P. filifolia* Vasey, Contr. Nat. Herb. 1: 271. 1893, not Schur. 1866. *P. scabrifolia* Heller, Bull. Torr. Club 24: 310. 1897, based on *P. filifolia* Vasey. *P. spillmani* Piper, Erythea 7: 102. 1899. *P. capillarifolia* Scribn. & Williams, U. S. Dept. Agr. Div. Agrost. Circ. 9: 1. 1899, type *Hansen* 2614.

26. **P. nevadensis** Vasey. Tufted perennial; culms 1½ to 3 feet high, smooth; sheaths scabrous; ligule 2 lines long, decurrent; blades firm, involute, scabrous; panicle narrow, 4 to 6 inches long; spikelets 3 to 4 lines long, narrow; glumes narrow, the second 1½ lines long; lemmas smooth or scaberulous, not pilose or webbed, 1½ lines long.

Plains and dry meadows; San Bernardino and Los Angeles cos., through eastern California to Wyoming and Colorado.

Locs.—Siskiyou Co., *Heller* 8070; Moulton, *Griffiths & Hunter* 463; Honey Lake Valley, *Davy* 3305, 3319; Chat, *Jones;* Sierra Valley, *Lemmon* 4672, 5461; Mt. Tallac, *Hitchcock* 3117; Ebbetts Pass, *Brewer* 1999; Bishop, *Heller* 8354; Antelope Valley, *Davy* 2246; Mohave Desert, *Parish* 4888; San Bernardino Mts., *Parish Bros.* 1543.

Ref.—Poa nevadensis Vasey; Scribn. Bull. Torr. Club 10: 66. 1883.

27. **P. brachyglossa** Piper. Tufted perennial; culms glabrous, 1½ to 3 feet high; sheaths smooth; ligule of the culm leaves about 1 line long; blades stiff and firm, flat or involute; panicle narrow, 4 to 8 inches long, the branches ascending; spikelets 4 to 5 lines long; glumes smooth, 2 to 2½ lines long; lemmas smooth or nearly so, firm.

Dry slopes and cliffs, British Columbia to Utah and northern California. Klamath River, *Butler* 467; Lassen Co., *Davy, Baker & Nutting;* Mt. Lola, *Kennedy & Doten* 182.

Ref.—Poa brachyglossa Piper, Proc. Biol. Soc. Wash. 18: 145. 1905.

28. **P. pringlei** Scribn. Tufted perennial; culms 4 to 10 inches high, the base sometimes decumbent and rhizome-like; sheaths smooth, loose and papery; blades mostly basal, involute, usually not over 1 or 2 inches long, smooth, the uppermost culm blade at or below the middle; panicle narrow, contracted, few-flowered; spikelets 3 to 4 lines long, about 3-flowered; glumes equal, broad, 3-nerved, 2 to 3 lines long; lemmas 2½ to 3 lines long, smooth or scabrous, not webbed or pilose.

High mountains of California.

Locs.—Mt. Shasta, *Copeland* 3894, *Goodale, Jepson;* head of Trinity River, *Pringle;* Mt. Stanford, *Sonne* 15; Donner Pass, *Heller* 7157; Butte Co., *Austin* 118; Mt. Goddard, *Hall & Chandler* 691; Mt. Tallac, *Hitchcock* 3151; Castle Peak, *Leiberg* 5303; Tuolumne Meadows, *McLean;* Farewell Gap, *Purpus* 5207; Mt. Whitney, *Coville & Funston* 2066; Mt. Pinos, *Hall* 6546.

Ref.—Poa pringlei Scribn. Bull. Torr. Club 10: 31. 1883, type from headwaters of Sacramento River, *Pringle* in 1882.

29. **P. leibergii** Scribn. Tufted perennial; culms 3 to 8 inches high; sheaths smooth; ligule about 1 line long; blades mostly basal, firm, involute, smooth, short; panicle narrow, 1 to 2 inches long, usually purple, the branches short, appressed; spikelets 2 to 3 lines long; glumes 1½ to 2 lines long; lemmas 1½ lines long, smooth or scaberulous, not webbed or pilose, the nerves obscure.—Differs from P. pringlei in the smaller spikelets; from P. hanseni in the smooth and firmer blades.

Alpine meadows and sterile gravelly alpine flats, high Sierra Nevada at about

12,000 feet altitude: Mt. Lyell, *Hitchcock* 3294, 3296, 3300, 3302; Lyell Fork Cañon, *Hitchcock* 3290; Siberian Outpost, *Hitchcock* 3436, 3451, 3452. The type, from southeastern Oregon, is the only other collection known.

Ref.—Poa leibergii Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 8: 6. pl. 2. 1897.

30. **P. cottoni** Piper. Tufted perennial; culms erect, smooth, scabrous below panicle, 1 to 2 feet high; sheaths smooth or slightly scabrous; ligule less than ½ line long; blades involute, erect, scabrous; panicle long-exserted, oblong, contracted, sometimes almost spike-like, 1 to 2 inches long; spikelets about 3 lines long; glumes broad, smooth, scarcely scabrous on the keel, the first 1½ lines long, the second a little longer; lemmas 2 lines long, smooth or minutely scabrous, not webbed at base, nerves all prominent.

Rocky woods, and along mountain streams, high Sierra Nevada, north to Washington.

Locs.—Pine Creek, *Baker & Nutting, Davy;* Nevada Co., *Sonne;* Sierra Valley, *Lemmon* 5463; Lake Tahoe, *Hitchcock* 3154, *Reed & Pendleton* 1624; Mt. Lyell, *Hitchcock* 3298; Farewell Gap, *Hitchcock* 3386; Mt. Whitney, *Hitchcock* 3449.

Ref.—Poa cottoni Piper, Proc. Biol. Soc. Wash. 18: 146. 1905.

59. GLYCERIA R. Br.

Spikelets few to many-flowered, subterete or slightly compressed, in narrow or spreading panicles. Glumes unequal, short, obtuse or acute. Lemmas convex, firm, with a scarious margin or apex, usually obtuse, awnless, 5 to 9-nerved, the nerves usually prominent. Usually tall aquatic perennials.—Species about 16, temperate regions of both hemispheres. (Greek glukeros, sweet.)

Spikelets linear, over 5 lines long.
  Lemmas about 2½ lines long ..... 1. *G. plicata.*
  Lemmas about 1¾ lines long.
    Spikelets about ½ line wide, green; lemmas smooth or minutely scabrous on the nerves... 2. *G. borealis.*
    Spikelets about 1 line wide, purplish tinged; lemmas scabrous on the nerves and somewhat so between them ..... 3. *G. leptostachya.*
Spikelets ovate or oblong, not over 2½ lines long.
  Lemmas with 5 prominent nerves.
    Panicle ovate or pyramidal, open ..... 4. *G. pauciflora.*
    Panicle narrow, branches ascending ..... 5. *G. erecta.*
  Lemmas with 7 prominent nerves ..... 6. *G. elata.*

1. **G. plicata** Fries. Culms ascending from a decumbent rooting base, rather thick and succulent, 4 to 5 feet tall; sheaths smooth; blades 1½ to 5 lines wide, scabrous above; panicle long and narrow; glumes very unequal, obtuse, the second 1½ lines long; lemmas purple-tinged, broad, obtuse, 2½ lines long, prominently 7-nerved, with an additional short pair near the margin, very scabrous on the nerves and somewhat so between them; palea about as long as lemma.

In shallow water, Mendocino Co. (Sherwood, *Davy* 5183, *Hitchcock* 2710; Walker Valley, *Davy & Blasdale* 5083); Oregon to Vancouver Island.

Ref.—Glyceria plicata Fries, Mant. 3: 176. 1842.

2. **G. borealis** Batchelder. Culms 2 to 3 feet high, erect from a more or less decumbent and rooting base; sheaths smooth or slightly scabrous, keeled; blades flat or usually folded, scabrous above, erect, 1½ to 2 lines wide; panicle long and narrow, the branches and slender pedicels appressed; spikelets narrow, nearly terete, ½ to ¾ inch long, ½ line wide, pale, not purple-tinged; glumes 1-nerved, the first ¾ line, the second 1½ lines long; lemmas oblong, 2 lines long, 7-nerved, smooth or indistinctly scabrous on the nerves.

In shallow water, central and northern California; eastward to Colorado, New Brunswick and Connecticut.

Locs.—Mt. Shasta, *Palmer* 2614 in 1892; Warner Mts., *Griffiths & Hunter* 452; Tahoe, *Hitchcock* 3102; Placer Co., *Carpenter;* Petaluma, *Elmer* 4652; Yosemite Valley, *Hitchcock* 3237.

Refs.—GLYCERIA BOREALIS Batchelder, Proc. Manchester Inst. Arts & Sci. 1: 74. 1900. *Panicularia borealis* Nash, Bull. Torr. Club 24: 348. 1897. *Glyceria fluitans* [R. Br. misapplied by] Thurb. in Wats. Bot. Cal. 2: 307. 1880; the preceding and following species are also probably included.

3. **G. leptostachya** Buckl. Culms about 4 feet high; sheaths smooth; blades minutely and sparsely scabrous above, about 2 lines wide; panicle long and narrow; spikelets ½ to ¾ inch long, about 1 line wide; lemma oblong, truncate, more or less purple-tinged, about 1½ lines long, prominently 7-nerved, distinctly scabrous on and between the nerves.

In shallow water, Sonoma Co. (Guerneville, *Davy* 6005; Sonoma, *Heller* 5606). Also in Oregon.

Refs.—GLYCERIA LEPTOSTACHYA Buckl. Proc. Acad. Phila. 1862: 95. 1862. *Panicularia davyi* Merr. Rhodora 4: 145. 1902, type *Davy* 6005.

4. **G. pauciflora** Presl. Culms 1 to 4 feet high, from a decumbent rooting base, with creeping rhizomes; sheaths smooth or scabrous; blades scattered, 3 to 6 lines wide, scabrous; panicle pyramidal, nodding, 4 to 8 inches long, open, the branches spreading, naked below, rather densely flowered toward the ends; spikelets about 2 lines long, oblong, about 5-flowered; glumes short, broad, obtuse, ½ and ¾ line long; lemmas 1 line long, oblong, rounded and somewhat erose at summit, prominently 5-nerved, very scabrous on the nerves and somewhat so between.

Swamps, shallow water and wet meadows; Kern Cañon (*Hitchcock* 3421) northward in the Sierra Nevada, and San Francisco (*Davy* 728) northward along the coast to British Columbia; east to Montana and Colorado.

Refs.—GLYCERIA PAUCIFLORA Presl, Rel. Haenk. 1: 257. 1830; Thurb. in Wats. Bot. Cal. 2: 308. 1880. *Panicularia pauciflora* Kuntze, Rev. Gen. Pl. 2: 783. 1891; Davy in Jepson, Fl. W. Mid. Cal. 68. 1901. *P. multifolia* Elmer, Bot. Gaz. 36: 54. 1903.

5. **G. erecta** Hitchc. n. sp. Culms slender, 1 to 2 feet high, erect from a decumbent rooting base, with creeping rhizomes; sheaths smooth, numerous and overlapping at base, the ligule broad and scarious, 1½ to 2 lines long; blades mostly basal, short and erect, flat, 2 to 3 lines wide, scabrous on both surfaces or nearly smooth; panicle long-exserted, narrow, 2 to 3 inches long, the short branches ascending; spikelets oblong, 2½ to 3 lines long, pale or purple-tinged, 4 to 6-flowered; glumes broad, obtuse, 1-nerved, the first about ½, the second about 1 line long; lemmas about 1¼ lines long, smooth, distinctly but not prominently 5-nerved, the apex scarious, erose-toothed; palea about as long as lemma.—(Culmi tenues recti, ad basin decumbentes, e rhizomatibus repentibus; vaginae numerosae deorsum imbricatae; ligula 1½-2 lin. longa; laminae breves, rectae, planae, 2-3 lin. latae, scabrae; panicula angusta, 2-3 pol. longa, ramis brevibus, ascendentibus; spiculae oblongae, 2½-3 lin. longae, 4-6-florae; glumae latae, obtusae, 1-nerviae, prima ½ lin. altera 1 lin. longa; lemmata circa 1½ lin. longa, levigata, 5-nervia apice scariosa erosaque; palea lemmate subaequilonga.)

Springy places in mountain meadows, Sierra Nevada to southern Oregon.

Type: *Hitchcock* 3250½ in the National Herbarium, Sunrise Creek, Yosemite National Park, August 19, 1908. In California this species has been collected at: Summit Valley, *Pringle* in 1882; Mt. Tallac, *Hitchcock* 3157; Yosemite Nat. Park, *Hitchcock* 3223, 3250½; Northfork,

Griffiths 6645, 6649; Madera Co., *Congdon;* Hockett Meadow, *Hitchcock* 3468; Farewell Gap, *Purpus* 5151; Whitney Meadows, *Coville & Funston* 1676. In Nevada at Glenbrook, Lake Tahoe *(Hitchcock* 3198, 3205). In Oregon in the Crater Lake region *(Coville & Leiberg* 392, *Coville* 1458, *Hitchcock* 3044, 3059).

6. **G. elata** Hitchc. n. comb. Culms erect, smooth, succulent, 3 to 6 feet high; sheaths scabrous; blades flat, usually 3 to 5 lines or sometimes only 2 lines wide, scabrous; panicle large and diffuse, becoming oblong, 6 to 12 inches long, the branches naked below, the lower usually reflexed at maturity; spikelets 1½ to 2½ lines long, oblong or ovate-oblong, usually 6 to 8-flowered; glumes broad, obtuse, much shorter than the lower lemmas, nerveless, the first about ½ line long; lemmas firm, obovoid, obtuse or acutish, prominently 7-nerved.—This may be only a form of G. nervata Willd., but the California specimens differ from the eastern and northern representatives of that species in being taller and more succulent, and in having wider blades, more oblong panicle with the lower branches often reflexed, and larger spikelets.

Wet meadows, springs, and shady moist soil in woods, in the Coast Ranges to the Bay region, in the Sierra Nevada, and the high southern mountains; north to British Columbia and east to Idaho.

Refs.—GLYCERIA ELATA Hitchc. *Panicularia clata* Nash, in Rydb. Mem. N. Y. Bot. Gard. 1: 54. 1900. *P. nervata clata* Piper, Contr. Nat. Herb. 11: 140. 1906. *Glyceria nervata* [Trin. misapplied by] Thurb. in Wats. Bot. Cal. 2: 307. 1880.

60. PUCCINELLIA Parl.

Spikelets several-flowered, terete, in open or narrow panicles. Glumes unequal, short. Lemmas rounded on the back, obtuse, firm, obscurely nerved. Perennial grasses with pale spikelets; growing along the seacoast or in alkaline soil, differing from Panicularia chiefly in the obscurely nerved lemmas.—Species 14, in northern extratropical regions of both hemispheres. (Prof. Benedetto Puccinelli, an Italian botanist.)

Panicle open, the branches spreading.
Leaves mostly in a short radical cluster; panicle usually less than 4 inches long.....
1. *P. lemmoni.*
Leaves scattered; panicle usually more than 4 inches long.....2. *P. nuttalliana.*
Panicle narrow, the branches ascending or appressed.
Panicle branches long, ascending; plant stout, 1½ to 2 feet high.....3. *P. festucaeformis.*
Panicle strict, the branches short and appressed; plants lower.
Blades involute; culms about 1 foot high.....4. *P. angustata.*
Blades flat, soft and lax; culms 3 to 8 inches high.....5. *P. simplex.*

1. **P. lemmoni** Scribn. Culms slender, 6 to 15 inches high; blades short, filiform, mostly basal, smooth, involute; panicle 2 to 4 inches long, becoming open, the branches spreading; spikelets 2½ to 3 lines long; glumes 1-nerved, 1 and 1½ lines long; lemmas 1½ lines long, smooth.

Alkaline soil, in the northern Sierra Nevada (Sierra Valley, *Bolander*). Nevada to Assiniboia.

Refs.—PUCCINELLIA LEMMONI Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17: 276. f. 572. 1899. *Poa lemmoni* Vasey, Bot. Gaz. 3: 13. 1878, type from Sierra Co., *Lemmon.* This and several other species are included under *Atropis distans* by Thurber (Wats. Bot. Cal. 2: 308. 1880).

2. **P. nuttalliana** Hitchc. n. comb. Culms tufted, erect, 1½ to 2 feet high; sheaths and involute blades smooth; panicle open, 6 to 8 inches long, the branches spreading, naked below; spikelets terete, about 3 lines long, usually pale; glumes acutish, the first 1-nerved, ½ line long, the second 3-nerved, 1 line long; lemmas about 1½ lines long, sparsely pubescent at base.

Alkaline soil, Dakotas to California and Texas.

Locs.—Warner Mts., *Griffiths & Hunter* 390; Honey Lake Valley, *Davy;* Livermore Pass, *Davy;* Ft. Tejon, *Davy* 2367; Santa Ana, *Bradshaw;* San Bernardino Mts., *Parish Bros.* 1559; San Diego, *G. R. Vasey.*

Refs.—PUCCINELLIA NUTTALLIANA Hitchc. *Poa nuttalliana* Schult. Mant. 2: 303. 1824, based on *Poa airoides* Nutt. *Puccinellia airoides* Wats. & Coult. in Gray, Man. ed. 6. 668. 1890. *Poa airoides* Nutt. Gen. Pl. 1: 68. 1818, not Koeler, 1802.

3. **P. festucaeformis** Parl. Culms in small tufts, rather stout, 1½ to 2 feet high; leaves scattered, smooth, the blades loosely involute, more or less spreading; panicle narrow, 4 to 6 inches long, the branches appressed, the lower as much as 3 inches long; spikelets about 4 lines long; glumes nearly equal, 3-nerved, narrow, about 1½ lines long; lemmas 2 lines long, smooth.

Saline soil near the coast, California to Alaska. Pt. Reyes, *Davy* 6749; San Mateo Co., *Jaffa* in 1900.

Refs.—PUCCINELLIA FESTUCAEFORMIS Parl. Fl. Ital. 1: 368. 1848. *Poa festucaeformis* Host, Gram. Austr. 3: 12. 1805.

4. **P. angustata** Nash. Culms erect, tufted, about 1 foot high; blades involute, erect, smooth; panicles narrow, 2 to 3 inches long, the branches about 1 inch long, appressed; spikelets about 3 lines long; glumes 3-nerved, the first 1 line, the second 1½ lines long; lemmas 1½ lines long, sparingly pubescent at base, especially on the lower part of the rather prominent marginal nerves.

Saline soil, Mendocino Co. (Ft. Bragg, *Davy & Blasdale* 6126) to Alaska; also on the Atlantic Coast from Connecticut northward.

Refs.—PUCCINELLIA ANGUSTATA Nash, Bull. Torr. Club 22: 512. 1895. *Poa angustata* R. Br. App. Parry's Voy. 287. 1824.

5. **P. simplex** Scribn. Apparently annual; culms 3 to 8 inches high; blades narrow, soft, flat, scattered; panicle narrow, about ½ the length of the entire plant, the branches few, short, and appressed; spikelets 3 to 4 lines long, appressed; glumes strongly 3-nerved, ½ and 1 line long; lemmas 1¾ lines long, tapering from below the middle to the acute apex, pubescent on lower half.

Alkaline soil; only known from California. Woodland; Livermore Pass, *Davy;* Tulare Co., *Congdon.*

Refs.—PUCCINELLIA SIMPLEX Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 16: 1. f. 1. 1899, type from Woodland, *Blankinship* in 1893.

61. FESTUCA L.

Spikelets 2 to several-flowered in narrow or open panicles. Glumes narrow, acute, the first 1-nerved, the second 3-nerved. Lemmas firm, rounded on the back, at least below, acute or awned from tip, rarely obtuse or awned from a cleft apex, faintly 3 to 5-nerved. Annuals or perennials, usually tufted.—Species about 100, throughout the temperate and cooler parts of the world. (An ancient Latin name for a kind of grass.)

Plants annual.
- Spikelets densely 5 to 13-flowered; lemmas without scarious margin.....1. *F. octoflora.*
- Spikelets loosely 1 to 5-flowered; lemmas with narrow scarious margin.
  - Branches of the short panicle normally divergent, a pulvillus at the base of at least 1 of them.
    - Florets mostly 3 to 5 in each spikelet; only the principal panicle branches divergent.
      - Lemmas glabrous.
        - Glumes glabrous .....2. *F. pacifica.*
        - Glumes hirsute .....3. *F. confusa.*
      - Lemmas hirsute.
        - Glumes glabrous .....4. *F. eriolepis.*
        - Glumes hirsute .....5. *F. grayi.*

Florets mostly 1 to 3 in each spikelet; all the spikelets divergent.
Lemmas glabrous .....6. *F. reflexa.*
Lemmas pubescent.
Glumes glabrous .....7. *F. microstachys.*
Glumes pubescent .....8. *F. eastwoodae.*
Branches of the narrow panicle erect or appressed.
Lower glume ⅔ to ¾ as long as the upper.....11. *F. bromoides.*
Lower glume not more than ½ as long as upper.
Lemma ciliate .....9. *F. megalura.*
Lemma not ciliate .....10. *F. myuros.*
Plants perennial.
Rhizomes present; blades flat; lemma acuminate, unawned.....25. *F. confinis.*
Rhizomes wanting (base of culm decumbent in F. rubra).
Blades flat, rather soft and lax.
Lemmas awnless, indurated, not keeled.....21. *F. elatior.*
Lemmas awned, membranaceous, more or less keeled.
Floret long-stipitate .....22. *F. subuliflora.*
Floret sessile.
Awn terminal .....24. *F. subulata.*
Awn from a cleft apex.....23. *F. elmeri.*
Blades usually folded or involute, narrow or capillary.
Collar and auricles tomentose or bristly.
Plant stout, usually over 3 feet tall; lower sheaths glabrous....19. *F. californica.*
Plant more slender, about 1½ feet tall; sheaths puberulent.....20. *F. parishii.*
Collar and auricles not conspicuously tomentose or bristly.
Lemmas acute, unawned or only awn-pointed.....18. *F. viridula.*
Lemmas awned.
Tufts loose, the bases of the culms decumbent; blades usually smooth to the touch..
12. *F. rubra.*
Tufts compact; culms erect.
Panicle open, the branches long and spreading; awn longer than body of lemma..
14. *F. occidentalis.*
Panicle narrow, the branches ascending.
Blades scabrous, usually elongated.....15. *F. idahoensis.*
Blades smooth.
Plants about 4 feet tall.....13. *F. howellii.*
Plants low, usually less than 6 inches high.
Blades hard, involute, shining, not angled.....17. *F. supina.*
Blades soft, angled in drying, the tissue soft between the angles.....
16. *F. brachyphylla.*

Subgenus VULPIA Hack. Annuals; stamens usually only 1, sometimes 3; florets usually remaining unopened, consequently self-pollinated; joints of the rachilla usually clavate.

1. **F. octoflora** Walt. Culms slender, erect, usually 6 to 12 inches high; blades narrow, involute; panicle narrow, the branches short, appressed; spikelets 3 to 4 lines long, densely 5 to 13-flowered; glumes subulate-lanceolate, the first 1-nerved, 1½ lines long, the upper 3-nerved, 2 lines long; lemmas firm, convex, lanceolate, glabrous or scabrous, the margins not scarious, 2 to 2½ lines long, attenuate into a scabrous awn 1 to 2 lines long.

Open ground, in the southwestern portion of the state, also in Santa Clara Co. (*Heller* 7373); throughout the U. S.

Var. **hirtella** Piper. Differs in being usually in low spreading tufts; foliage usually pubescent; lemmas hirtellous or pubescent.—More frequent than the species, growing in more arid ground; San Luis Obispo Co. to the Mohave Desert and southward; also on Mt. Tamalpais (*Chase* 5678) and in northern Inyo Co. (*Heller* 8196); southeast to Arizona and northern Mexico.

Refs.—Festuca octoflora Walt. Fl. Carol. 81. 1788; Abrams, Fl. Los Ang. 52. 1904. *F. tenella* Willd. Sp. Pl. 1: 419. 1797; Thurb. in Wats. Bot. Cal. 2: 317. 1880. Var. hirtella Piper, Contr. Nat. Herb. 10: 12. 1906.

2. **F. pacifica** Piper. Culms slender, erect, 1 to 2 feet high; blades soft, glabrous, loosely involute; panicle 2 to 5 inches long, the lower branches solitary, divaricate; spikelets 3 to 6-flowered; glumes glabrous, the first subulate-lanceolate, 1-nerved, 2 lines long, the second lanceolate-acuminate, 3-nerved, 2½ lines long; lemmas lanceolate, scabrous, except in the lowermost floret (this smooth), 3 to 3½ lines long, attenuate into a scabrous awn 5 to 7 lines long.

Open ground, mountain slopes and open woods, throughout the state, except the Great Valley and the Mohave Desert; extends from British Columbia to Arizona and Lower California.

Ref.—Festuca pacifica Piper, Contr. Nat. Herb. 10: 12. 1906.

3. **F. confusa** Piper. Differs from F. pacifica in having hirsute glumes; plants small and slender; sheaths and blades pubescent; spikelets 2 or 3-flowered.

Dry hillsides, middle California to Washington. Mt. Diablo, *Brewer* 1142, *Hall* 1737; Northfork, *Griffiths* 4608c; Santa Lucia Mts., *Eastwood*.

Ref.—Festuca confusa Piper, Contr. Nat. Herb. 10: 13. pl. 1. 1906.

4. **F. eriolepis** Desv. Culms 4 to 15 inches high; sheaths glabrous or pubescent; blades soft, loosely involute, usually glabrous; panicle 1 to 3 inches long, the solitary rays at length divaricate; glumes lanceolate, glabrous, the first 3 to 3½ lines long, the second a little longer; lemmas lanceolate, densely villous, 3 to 3½ lines long, attenuate into a scabrous awn nearly as long.

Sandy ground, northern California and Nevada; also Chile.

Locs.—Modoc Co., *Griffiths & Hunter* 406; Castella, *Piper* 6346; Ukiah, *Bolander* 6118; Truckee, *Sonne* 7.

Refs.—Festuca eriolepis Desv. in Gay, Fl. Chil. 6: 428. 1853. *F. arida* Ehmer, Bot. Gaz. 36: 52. 1903.

5. **F. grayi** Piper. Habit of F. pacifica, but somewhat stouter; sheaths and sometimes blades pubescent; glumes and lemmas pubescent or puberulent throughout; spikelets 3 to 5-flowered.

Open ground and rocky slopes; Yolo Co. (*Blankinship* 20) and Amador Co. (*Hansen* 632) to Ventura Co. (*Hubby* 40) and Imperial Co. (*Schoenfeldt* 3634 in part); north to Oregon and east to Arizona.

Refs.—Festuca grayi Piper, Contr. Nat. Herb. 10: 14. 1906. *F. microstachys* Nutt. var. *grayi* Abrams, Fl. Los Ang. 52. 1904. Var. *ciliata* Gray; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901.

6. **F. reflexa** Buckl. Culms 8 inches to 1½ feet high; sheaths smooth or pubescent; blades narrowly linear, flat or loosely involute; panicle 2 to 5 inches long, the solitary rays and the spikelets all at length divaricate; spikelets 1 to 3-flowered, 2½ to 3½ lines long; glumes glabrous, the first 1 to 2 lines long, the second 2 to 2½ lines long; lemmas glabrous or somewhat scabrous, 2½ to 3 lines long, attenuate into a scabrous awn, usually 2½ to 4 lines long.

Mesas, rocky slopes and wooded hills; Mendocino Co. (*Davy* 5049) to San Diego (*Orcutt* 1073), also in Madera Co. (*Griffiths* 4423), Kern Co. (*Davy* 1898) and Panamint Mts. (*Coville & Funston* 775); north to Vancouver Island and east to Utah.

Refs.—Festuca reflexa Buckl. Proc. Acad. Phila. 1862: 98. 1863, type collected by Nuttall in "Upper California." *F. microstachys* Nutt. var. *pauciflora* Scribn.; Beal, Grasses N. Am. 2: 586. 1896; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901.

7. **F. microstachys** Nutt. Habit of F. reflexa; differing in having pubescent lemmas.—Less frequent than that species.

Banks, hillsides and open ground, California to Oregon.

Locs.—Napa City, *Jepson* in 1893; Yosemite Nat. Park, *Chase* 5702; Carmel Mission, *Heller* 6583; Salt Creek, Tulare Co., *Eastwood* in 1894 in part; Pasadena, *Allen* in 1885.

Refs.—Festuca microstachys Nutt. Jour. Acad. Phila. II. 1: 187. 1848, type from "Pueblo de los Angeles, Upper California"; Thurb. in Wats. Bot. Cal. 2: 317. 1880; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901; Abrams, Fl. Los Ang. 51. 1904.

8. **F. eastwoodae** Piper. Differs from F. reflexa in having pubescent glumes and lemmas. Rare.

Open pine forests: Santa Lucia Mts.; Salt Creek, Tulare Co., *Eastwood* in 1894 in part; Voleano, collector unknown.

Ref.—Festuca eastwoodae Piper, Contr. Nat. Herb. 10: 16. 1906, type from Santa Lucia Mts., *Eastwood* in 1897.

9. **F. megalura** Nutt. Culms 8 inches to 2 feet high; sheaths and blades smooth; panicle narrow, 3 to 8 inches long, the branches appressed; spikelets 4 or 5-flowered; glumes glabrous, very unequal, the first about 1 line long or less, the second 2 to 2½ lines long; lemmas linear-lanceolate, scabrous above, ciliate on the upper half, attenuate into an awn about twice its length.—The cilia on the lemmas, by which this species is distinguished from F. myuros, are sometimes hidden by the incurved edges of the lemma at maturity.

Cultivated or open ground, sandy soil, and waste places, mostly in the Coast Ranges; extends from British Columbia to Idaho and Lower California.

Refs.—Festuca megalura Nutt. Jour. Acad. Phila. II. 1: 188. 1848, type from Santa Barbara, *Gambel*. *F. myuros* L. var. *ciliata* [Coss. misapplied by] Davy in Jepson, Fl. W. Mid. Cal. 70. 1901; Abrams, Fl. Los Ang. 52. 1904. This is included under *F. myuros* L. by Thurber (Wats. Bot. Cal. 2: 316. 1880).

10. **F. myuros** L. Similar to F. megalura but lemmas not ciliate.

Open ground, introduced from Europe into the Eastern States; rare on the Pacific Coast. San Francisco, Wilkes Exped.; San Diego, *Brandegee* 86 in part; Santa Catalina Island, *Brandegee* 53.

Refs.—Festuca myuros L. Sp. Pl. 74. 1753; Thurb. in Wats. Bot. Cal. 2: 316. 1880; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901; Abrams, Fl. Los Ang. 32. 1904.

11. **F. bromoides** L. Similar to F. megalura; culms 4 to 12 inches high; panicle dense, 2 to 4 inches long; glumes unequal, the first 2 lines long, the second 3 to 3½ lines long; lemma 3½ to 4 lines long, the awn 5 to 6 lines long.

Dry hills and meadows, Santa Barbara and San Bernardino cos. to Vancouver Island; introduced from Europe.

Refs.—Festuca bromoides L. Sp. Pl. 75. 1753. *F. sciuroides* Roth, Cat. Bot. 2: 11. 1800. *F. myuros* L. var. *sciuroides* Coss. in Coss. & Dur. Expl. Algér. 2: 174. 1867.

Subgenus Eufestuca Griseb. Perennials, often densely tufted, sometimes decumbent at base but not producing scaly rhizomes.

12. **F. rubra** L. Culms erect from a decumbent or somewhat creeping base, smooth, 1½ to 3 feet high; sheaths smooth, the lowermost usually purple; blades smooth, soft, usually folded or involute; panicle 2 to 8 inches long, usually contracted and narrow, the rays mostly erect; spikelets 4 to 6-flowered, pale green or glaucous, often purple-tinged; lemmas 2½ to 3½ lines long, smooth, or scabrous toward apex, bearing a scabrous awn usually about ½ as long.

Meadows and hills, in the Sierra Nevada and San Bernardino mountains, and in the Coast Ranges as far south as Monterey. Northern part of the north-

ern hemisphere, in America extending south to Virginia, Colorado, and southern California.

Refs.—Festuca rubra L. Sp. Pl. 74. 1753; Davy in Jepson, Fl. W. Mid. Cal. 68. 1901. *F. ovina* L. var. *rubra* Gray, Man. ed. 5. 633. 1867; Thurb. in Wats. Bot. Cal. 2: 317. 1880. *F. rubra* var. *multiflora* Aschers. & Graebn. Syn. Mitteleur. Fl. 2: 499. 1900. Var. *densiuscula*. Hack.; Piper, Contr. Nat. Herb. 10: 22. 1906 (as subsp.). Var. *pruinosa* Hack. in Rep. Bot. Exchange Club Brit. Isles 119. 1884.

Piper has recognized three subspecies of F. rubra in California (Contr. Nat. Herb. 10: 22. 1906): *F. rubra multiflora* Aschers. & Graebn. Lake Tahoe, *Hitchcock* in 1901; Bear Valley, *Lemmon* 5434. A specimen collected by Anderson at Santa Cruz appears to belong to this form. *F. rubra pruinosa* Hack. Ft. Bragg, *Davy & Blasdale* 6117; Pt. Reyes, *Davy* 6811. *F. rubra densiuscula* Hack. Crescent City, *Davy & Blasdale* 5931, 5932. These specimens appear to belong to the same form as the two preceding.—These forms appear to be scarcely worthy of varietal rank. The first is distinguished chiefly by being tall and stout and by having flat blades. The second and third by the denser panicle and glaucous spikelets, the second having green leaves and the third glaucous leaves.

13. **F. howellii** Hack. Resembling F. rubra but tall and stout, about 4 feet high; culms numerous, erect at base, in a close tuft; blades a foot or more long, folded, smooth; spikelets larger, in the lemmas about 3½ lines long, awned.

Sherwood Valley, *Davy & Blasdale* 5231; rocky woods, Sherwood, *Hitchcock* 2706, 2716; Mt. Hood, Sonoma Co., *Heller* 5628. The specimens mentioned may be forms of the variable F. rubra, but they agree in the characters given. *Heller* no. 5628 is a good match for the type from Deer Creek Mt., Oregon (*Howell* 248), the only other specimen known.

Ref.—Festuca howellii Hack.; Beal, Grasses N. Am. 2: 591. 1896.

14. **F. occidentalis** Hook. Culms densely tufted, slender, erect, shining, 1½ to 2½ feet high; sheaths smooth; blades numerous, mostly basal, filiform-involute, bright green, soft, 2 to 8 inches long; panicle loose, subsecund, 3 to 8 inches long, often drooping above, the rays solitary or the lowest in pairs; spikelets loosely 3 to 5-flowered, 3 to 5 lines long, mostly on slender pedicels, pale green; lemmas rather thin, 2½ to 3 lines long, scaberulous toward the apex, attenuate into a slender awn about as long.

Dry rocky wooded slopes and banks; Sequoia Nat. Park (*Davidson* 2114) and San Mateo Co. (*Baker* 1920); north to British Columbia and east to Wyoming and northern Michigan.

Ref.—Festuca occidentalis Hook. Fl. Bor. Am. 2: 249. 1840.

15. **F. idahoensis** Elmer. Blue Bunchgrass. Culms densely tufted, smooth or somewhat scabrous above, 1 to 3 feet high; blades numerous, mostly basal, rather stiff and firm, more or less flexuous, scabrous, 6 to 12 inches long, sometimes shorter; panicle narrow, 4 to 8 inches long, the branches appressed or ascending, very scabrous; spikelets about as in F. rubra, the lemmas firmer, the awn 1 to 2 lines long.

Open woods and rocky slopes; middle California to British Columbia, east to Alberta and Colorado.

Locs.—Warner Mts., *Griffiths & Hunter* 469, 472; Alturas, *Applegate* 898; Castella, *Piper* 6329; Trinity Co., *Blankinship* 11; Hupa, *Chandler* 1366; Mendocino Co., *Davy & Blasdale* 5314; Plumas Co., *Lemmon* 4653; Mt. Sanhedrin, *Heller* 5951; Hood's Peak, Sonoma Co., *Heller* 5629; Vaca Mts., *Jepson* in 1897; Congress Springs, *Hitchcock* 2655.

Refs.—Festuca idahoensis Elmer, Bot. Gaz. 36: 53. 1903. *F. ingrata* Rydb. Bull. Torr. Club 32: 608. 1905. *F. ovina* L. var. *ingrata* Hack.; Beal, Grasses N. Am. 2: 598. 1896.

16. **F. brachyphylla** Schult. Culms erect, tufted, low, 4 to 6 inches high; blades about ½ as long as the culms, filiform, soft, angled in drying, the tissue soft between the angles; panicle short and narrow, 1 to 2 inches long, few-

flowered; glumes and lemmas broad, rather soft; awn of the lemma about ½ line long.

Mt. Dana, above timber-line (the only known locality in California), *Bolander* (no. 6100) and *Brewer* (no. 5066 in part). Arctic America, south in the Rocky Mts. to Arizona and Blue Mts. of Oregon.

Refs.—FESTUCA BRACHYPHYLLA Schult. Mant. 3: 646. 1827. *F. brevifolia* R. Br. App. Parry's Voy. Suppl. 289. 1824, not Muhl. 1817. *F. ovina* L. var. *brevifolia* Wats. U. S. Expl. 40th Par. 5: 389. 1871; Thurb. in Wats. Bot. Cal. 2: 317. 1880. Rydberg refers the above specimens to F. minutiflora Rydb. Bull. Torr. Club 32: 608. 1905 (type from Colorado).

17. **F. supina** Schur. Culms erect, densely tufted, 3 to 6 inches high; blades numerous, usually less than ½ the length of the culm, involute, smooth, firm and hard, scarcely angled in drying; inflorescence about as in F. brachyphylla, the lemmas firmer, narrower, involute and more scabrous, the florets looser and more numerous and the awn longer.

In the high Sierra Nevada from Mono Lake south, and in the San Bernardino Mts., mostly above 11,000 feet altitude; extends from Greenland to the White Mts. of New Hampshire and from British Columbia and Alberta south in the mountains to Arizona and California.

Locs.—White Mts., *Shockley* 616; Mt. Dana, *Hall & Babcock* 3608; Mt. Lyell, *Hitchcock* 3293; Kings River, *Lemmon* in 1902; Denels Peak, *Hall & Babcock* 5514; Sawtooth Peak, *Hall & Babcock* 5676; Farewell Gap, *Purpus* 5117; Mt. Whitney, *Hitchcock* 3444; Grayback Mt., *Reed* 2740; San Gorgonio Mt., *Hall* 7639.

Refs.—FESTUCA SUPINA Schur. Enum. Pl. Transs. 784. 1866. *F. ovina* L. var. *supina* Hack. Bot. Centr. 8: 405. 1881.

18. **F. viridula** Vasey. Culms rather loosely tufted, erect, smooth, 2 to 3 feet high; sheaths smooth; blades erect, 1 line wide or less, soft, scaberulous above, often more or less involute; panicle loose and open, 4 to 6 inches long, the branches ascending; spikelets 3 to 6-flowered; glumes membranaceous, smooth, about 1½ lines long; lemmas firm, membranaceous, keeled toward the apex, acute or somewhat mucronate, 3 to 3½ lines long.

Subalpine meadows, Washington and Idaho to the high mountains of central California.

Locs.—Geysers, Sonoma Co., *Bolander* 3945; Webber Lake, *Leiberg* 5262; Donner Lake, *Davy* 3222; Sierra Valley, *Brewer* 1976; Mt. Tallac, *Hitchcock* 3155.

Refs.—FESTUCA VIRIDULA Vasey, U. S. Dept. Agr. Div. Bot. Bull. 13[3]: pl. 93. 1893, type collected in California by *Bolander*. *F. gracillima* [Hook. misapplied by] Thurb. in Wats. Bot. Cal. 2: 318. 1880.

19. **F. californica** Vasey. Culms tufted, stout, coarse, usually 3 to 5 feet high, scabrous, sheaths somewhat scabrous, the lower persistent, the collar and auricles pilose; blades flat or becoming involute when dry, hard and firm, scabrous, the lower much elongated; panicle large, usually loose and open, the branches few, long and slender, naked below, bearing a few large spikelets toward the ends; spikelets compressed, about 5-flowered; glumes oblong-lanceolate, firm, smooth, except the scabrous keel, 3 to 4 lines long; lemmas 4 to 5 lines long, lanceolate, convex, firm, scabrous, acuminate or short-awned.

Meadows, shady banks and borders of woods, in the Coast Ranges from Monterey Co. (*Davy* 7344) to Humboldt Co. (*Davy* 6599) and Mt. Shasta (*Heller* 7944); north to Oregon.

Refs.—FESTUCA CALIFORNICA Vasey, Contr. Nat. Herb. 1: 277. 1893, type from San Francisco, *Bolander* 1505; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901. *F. scabrella* [Torr. misapplied by] Thurb. in Wats. Bot. Cal. 2: 318. 1880. *F. kalmii* Gray var. *aristulata* Torr. U. S. Rep. Expl. Miss. Pacif. 4: 157. 1856, type from Mark West Creek, *Bigelow* in 1854. *F. aristulata* Shear; Piper, Contr. Nat. Herb. 10: 32. 1906. *Bromus depauperatus* [Presl, misapplied by] Thurb. in Wats. Bot. Cal. 2: 320. 1880. The specimen in the Gray Herbarium (*Bolander*

3945), upon which Thurber based his description, is *Festuca californica*. *Bromus depauperatus* Presl is said to have been collected by Haenke at Nootka Sound on Vancouver Island. The type specimen, in the Bohemian National Museum at Prague, is a species of Festuca closely allied to *F. elmeri* Scribn. & Merr. but appears to be different from any known species from the Northwestern States. There is nothing on the label accompanying the type specimen to indicate its origin and the published locality may be an error. In the type specimen the lemmas are firm, terete, indistinctly nerved, scabrous, long-acuminate, long-awned from between setaceous teeth. Presl's description is accurate.

20. **F. parishii** Hitchc. n. comb. Resembles F. californica but culms lower, about 1½ to 2 feet high; sheaths puberulent; blades 6 to 10 inches long, closely involute, smooth below or nearly so; panicle 4 to 5 inches long; awn of lemma 1½ to 2 lines long.

Only known from the San Bernardino Mts. (*Parish Bros.* 857, *Parish* 2490, 5036).

Refs.—Festuca parishii Hitchc. *F. aristulata* Shear subsp. *parishii* Piper, Contr. Nat. Herb. 10: 33. 1906, type *Parish* 5036.

21. **F. elatior** L. Meadow Fescue. Culms smooth, 2½ to 4 feet high; sheaths smooth; blades flat, 2 to 4 lines wide, scabrous above; panicle erect, or nodding at summit, 4 to 8 inches long, contracted after flowering, much-branched or nearly simple, the branches spikelet-bearing nearly to base; spikelets usually 6 to 8-flowered, 4 to 6 lines long; glumes 1½ and 2 lines long, lanceolate; lemmas oblong-lanceolate, coriaceous, 2½ to 3½ lines long, the scarious apex acutish.

Meadows and roadsides: Mt. Shasta, *Lemmon* 5458; Yreka, *Butler* 1636; Jess Valley, Modoc Co., *Griffiths & Hunter* 409. A native of Europe, cultivated in the U. S. under the name of Meadow Fescue, and escaped into fields and waste places throughout the cooler portion of America.

Refs.—Festuca elatior L. Sp. Pl. 75. 1753. *F. pratensis* Huds. Fl. Angl. 37. 1762.

22. **F. subuliflora** Scribn. Culms rather slender, glabrous, 2 to 3 feet high; sheaths sparsely hispidulous; blades flat, rather soft, hirsutulous above, 1½ to 3 lines wide; panicle loose, open, somewhat drooping, 4 to 8 inches long, the branches slender, mostly solitary, naked below the middle; spikelets loosely 3 to 4-flowered; glumes subulate, glabrous, 1-nerved, 1½ and 2 lines long; lemmas lanceolate, scabrous toward the apex, keeled above, 3 to 4 lines long, tipped with a more or less flexuous awn 5 to 7 lines long, abruptly contracted at base into a hispidulous tubular structure including the rachilla, the latter apparently disarticulating half way between the florets.

In the Coast Ranges of northern California, north to Vancouver Island.

Locs.—Crescent City, *Davy & Blasdale;* Humboldt Bay, *Chandler* 1184; Kneeland, *Blankinship* 7; Hubbard Sta., *Davy & Blasdale* 5407.

Refs.—Festuca subuliflora Scribn. in Macoun, Cat. Can. Pl. 5: 396. 1890. *F. denticulata* Beal, Grasses N. Am. 2: 589. 1896; Davy in Jepson, Fl. W. Mid. Cal. 69. 1901.

23. **F. elmeri** Scribn. & Merr. Culms slender, 1½ to 3 feet high, glabrous; sheaths nearly smooth; blades flat, scabrous or pubescent above, 1 to 2 lines wide; panicle 4 to 8 inches long, loose, open, the branches mostly in pairs, smooth or nearly so, naked below; spikelets 3 or 4-flowered; glumes lanceolate, glabrous, 1 and 1½ to 2 lines long; lemmas lanceolate, membranaceous, minutely hispidulous, 3 lines long, cleft at the apex and bearing between the short teeth a scabrous awn 1 to 4 lines long.

Wooded hillsides, California to Oregon, mostly in the Coast Ranges.

Locs.—Marysville Buttes, *Heller* 5562; Ukiah, *Davy & Blasdale* 5029; Lake Co., *Davy* 6648; San Francisco, *Bolander* 1507; Stanford University, *Abrams* 1646, *Elmer* 2101; Los

Gatos, *Heller* 7471; Santa Cruz, *Anderson;* Tassajara Hot Springs, *Elmer* 3322; Templeton, *Davy* 7584; San Luis Obispo, *Lemmon* 4654.

Var. **luxurians** Piper. Panicle rather close; spikelets 5 or 6-flowered.—Moist groves, San Francisco Bay region: Oakland, *Bolander* 6073; Stanford University, *Elmer* 2103, 2133.

Refs.—FESTUCA ELMERI Scribn. & Merr. Bull. Torr. Club 29: 468. 1902, type from Stanford University, *Elmer* 2101. Var. LUXURIANS Piper, Contr. Nat. Herb. 10: 38. 1906, based on the next. *F. jonesii* Vasey var. *conferta* Hack.; Beal, Grasses N. Am. 2: 593. 1896, type from San Jose Normal School, collector unknown.

24. **F. subulata** Trin. Culms scaberulous, 1½ to 4 feet high; sheaths nearly smooth; blades flat, thin, 1½ to 5 lines wide, auriculate at base, usually scabrous on both surfaces, lax and spreading; panicle very loose, somewhat drooping, 6 to 15 inches long, the branches mostly in pairs, naked below; spikelets 3 to 5-flowered; glumes subulate; lemmas membranaceous, narrowly lanceolate, 3-nerved, somewhat keeled, attenuate into a scabrous awn 3 to 10 lines long.

Moist rocky woods and shady banks, Alaska to Montana and Wyoming, south to California. Moulton, Warner Mts., *Griffiths & Hunter* 473; Sequoia Nat. Park, Redwood Meadows, *Hitchcock* 3380.

Refs.—FESTUCA SUBULATA Trin. in Bong. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 2: 173. 1832. *F. pauciflora* [Thunb. misapplied by] Thurb. in Wats. Bot. Cal. 2: 318. 1880.

Subgenus HESPEROCHLOA Piper. Perennials, densely tufted but producing occasional stout rhizomes or stolons.

25. **F. confinis** Vasey. Culms stout, erect, glabrous, 1½ to 3 feet high; sheaths smooth, striate; blades firm, flat or loosely involute, coarsely striate, 1½ to 3 lines wide; panicle narrow, erect, 3 to 8 inches long, the branches short and appressed, floriferous nearly to base; glumes broadly lanceolate, subscarious, nearly smooth, the first 1½ to 2 lines long, the second a half longer; lemmas ovate, acuminate, convex, faintly nerved, scabrous all over the back, 2½ to 4 lines long.

Dry meadows and hills; San Bernardino Mts., north to Oregon and east to Montana and Colorado.

Locs.—Truckee, *Sonne* 11; San Gorgonio Mt., *Abrams & McGregor* 778, *Hall* 7621; Coon Creek, San Bernardino Mts., *Hall* 7585.

Ref.—FESTUCA CONFINIS Vasey, Bull. Torr. Club 11: 126. 1884.

62. BROMUS L.

Spikelets few to many-flowered, terete or flattened, in narrow or open panicles. Glumes unequal, acute, 1 to 5-nerved. Lemmas convex or sharply keeled, 5 to 9-nerved, usually 2-toothed at apex and awned from between the teeth, sometimes awnless, the awn straight or divergent, sometimes twisted. Annuals or perennials with usually flat blades, and rather large spikelets.—Species about 100, mostly in the north temperate zone. (An ancient Greek name for the oat.)

Plants annual.
  Panicle contracted, dense.
    Awn 8 to 11 lines long.
      Culm pubescent below panicle ..... 11. *B. rubens.*
      Culm smooth ..... 9. *B. madritensis.*
    Awn 3 to 4 lines long.
      Awn divaricate; second glume 3-nerved ..... 8. *B. scoparius.*
      Awn straight; second glume 5 to 7-nerved ..... 4. *B. hordeaceus.*

Panicle open, the branches spreading.
Awn short or wanting.
Lemmas broad, obtuse ..... 7. *B. brizaeformis.*
Lemmas acuminate ..... 18. *B. unioloides.*
Awn well-developed (cf. B. carinatus).
Awn twisted and bent ..... 1. *B. trinii.*
Awn not twisted and bent.
Sheaths smooth; florets turgid; awn 1½ to 2½ lines long ..... 2. *B. secalinus.*
Sheaths pubescent; awn usually long.
Awn 1½ to 2 inches long ..... 10. *B. villosus.*
Awn not more than 8 lines long.
First glume 1-nerved ..... 12. *B. tectorum.*
First glume 3-nerved.
Lemmas pubescent ..... 6. *B. arenarius.*
Lemmas glabrous.
Awns all alike ..... 3. *B. commutatus.*
Awns of the lower florets shorter ..... 5. *B. japonicus.*
Plants perennial.
Spikelets subterete, not strongly flattened.
Panicle narrow, the branches erect ..... 17. *B. suksdorfii.*
Panicle open, the branches spreading.
Branches of panicle stiffly divaricate; blades short ..... 13. *B. orcuttianus.*
Branches drooping; blades elongated.
Lemmas pubescent throughout ..... 14. *B. grandis.*
Lemmas pubescent at margins or base only, or nearly glabrous.
Lemmas densely pubescent at base and margins; lower glume 3-nerved ..... 16. *B. laevipes.*
Lemmas sparsely pubescent on back, ciliate on margins or nearly glabrous; lower glume 1-nerved ..... 15. *B. vulgaris.*
Spikelets strongly flattened.
Blades canescent and densely pilose, narrow or involute ..... 19. *B. subvelutinus.*
Blades not canescent, glabrous or somewhat pilose, broader, flat.
Panicle narrow, the branches short and erect ..... 21. *B. maritimus.*
Panicle open, the branches spreading or drooping.
Awn less than 3½ lines long; blades rather broad ..... 20. *B. marginatus.*
Awn more than 3½ lines long; blades usually narrow ..... 22. *B. carinatus.*

DIVISION I. Introduced annuals (cf. B. unioloides in Div. 3).

1. **B. trinii** Desv. Culms erect, 1 to 2 feet high; sheaths pilose or nearly smooth; blades usually pilose; panicle narrow, 4 to 8 inches long, rather dense; spikelets narrow, 5 to 7-flowered, 7 to 10 lines long; glumes lanceolate, acuminate, smooth, the first mostly 1-nerved, 4 to 5 lines long, the second broader, mostly 3-nerved, 6 to 8 lines long; lemmas coarsely and sparsely pubescent, 5-nerved, 6 to 7 lines long, acuminate, with 2 narrow teeth 1 line long; awn 7 to 10 lines long, twisted below, bent below the middle and strongly divaricate when old.

Dry plains and rocky or wooded slopes: Klamath Bluffs, Siskiyou Co. (*Butler* 1185); San Francisco and Contra Costa cos. south, especially in desert regions; east to Colorado and south to Mexico; also Chile.

Var. **excelsus** Shear. Lemma 7-nerved, the awn scarcely twisted or bent.—A little known form which may prove to be a distinct species. The type is from the Panamint Mts. (*Coville & Funston* 522). Another specimen, *Wilder* 1062, from Glenavon, is doubtfully referred to this variety.

Refs.—BROMUS TRINII Desv. in Gay, Fl. Chil. 6: 441. 1853; Abrams, Fl. Los Ang. 53. 1904. Var. *pallidiflorus* Desv. in Gay, Fl. Chil. 6: 441. 1853; Abrams, Fl. Los Ang. 54. 1904. *Trisetum barbatum* Steud. Syn. Pl. Glum. 1: 229. 1854; Davy in Jepson, Fl. W. Mid. Cal. 52. 1901. Var. EXCELSUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 25. 1900.

2. **B. secalinus** L. CHEAT. CHESS. Culms erect, 1 to 2 feet high; sheaths smooth; panicle pyramidal, drooping, 3 to 5 inches long, open, the lower branches 3 to 5, unequal; spikelets ovoid-lanceolate, becoming somewhat laterally compressed and turgid in fruit, 5 to 9 lines long, 3 to 4 lines wide; glumes smooth, obtuse, the first 3 to 5-nerved, 2 to 3 lines long, the second 7-nerved, 3 to 3½ lines long; lemmas 7-nerved, 3 to 4 lines long, elliptic, obtuse, smooth or scabrous, the margin strongly involute in fruit, shortly bidentate at apex, the undulate awn usually 1½ to 2½ lines long; palea about as long as lemma.—In fruit the turgid florets are somewhat distant so that, viewing the spikelet sidewise, the light passes through the small openings at the base of each floret.

A weed in grain fields and waste places, more or less throughout the U. S., introduced from Europe.

Locs.—Yreka, *Butler* 826; Modoc Co., *Hall & Babcock* 4246; Dixie Valley, *Davy;* Hupa Valley, *Davy* 5688; Chat, *Davy;* Yosemite Nat. Park, *Hall & Babcock* 3398; Los Angeles.

Refs.—BROMUS SECALINUS L. Sp. Pl. 76. 1753; Thurb. in Wats. Bot. Cal. 2: 319. 1880; Abrams, Fl. Los Ang. 53. 1904.

3. **B. commutatus** Schrad. Resembling B. secalinus; sheaths pilose with short retrorse hairs; lemmas with an obtuse angle on the margin just above the middle, the margin not as strongly inrolled in fruit as in B. secalinus, the awn straight and rather longer.—In fruit the less turgid florets are imbricated, leaving no spaces at the base of the florets as in B. secalinus.

A weed in fields and waste places, Washington to California and Montana and more sparingly in the Eastern States. Introduced from Europe.

Locs.—Castle Crag, *Hitchcock* 3067; Sherwood Valley, *Davy & Blasdale* 5152; Ft. Bragg, *Davy & Blasdale* 6112; Pt. Reyes, *Davy* 6762; Santa Barbara, *Hitchcock* 2579; San Bernardino, *Parish* 2175.

Refs.—BROMUS COMMUTATUS Schrad. Fl. Germ. 353. 1806. *B. racemosus* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 320. 1880.

4. **B. hordeaceus** L. Culms 8 inches to 2½ feet high; sheaths retrorsely softly pilose-pubescent; blades usually pubescent; paniele contracted, erect, 2 to 4 inches long, or, in depauperate plants, reduced to a few spikelets; glumes broad, obtuse, coarsely pilose or scabrous-pubescent, the first 3 to 5-nerved, 2 to 3 lines long, the second 5 to 7-nerved, 3½ to 4 lines long; lemmas broad, obtuse, 7-nerved, coarsely pilose or scabrous-pubescent, rather deeply bidentate, 4 to 4½ lines long, the margin and apex hyaline; awn rather stout, 3 to 4½ lines long; palea about ¾ as long as lemma .

A weed in waste places and cultivated soil, abundant on the Pacific Coast, occasional in the Eastern States, introduced from Europe.

Var. **leptostachys** Beck. Differs in having glabrous, or only scabrous spikelets.—Waste places, Siskiyou Co. (*Butler* 817) to Yosemite Valley (*Bioletti* 16) and Stanford University (*Rutter* 2).

Refs.—BROMUS HORDEACEUS L. Sp. Pl. 77. 1753; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901; Abrams, Fl. Los Ang. 53. 1904. Var. LEPTOSTACHYS Beck, Fl. Niederösterr. 109. 1890. Var. *glabrescens* Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 20. 1900; Davy in Jepson, Fl. W. Mid. Cal. 72. 1901.

5. **B. japonicus** Thunb. Culms erect or geniculate at base, 1½ to 2½ feet high; sheaths and blades soft-pubescent; panicle 5 to 8 inches long, broadly pyramidal, diffuse, somewhat drooping, the lower branches 3 to 5, slender; glumes rather broad, the first narrower, acute, 3-nerved, 2 to 3 lines long, the second obtuse, 5-nerved, 3 to 4 lines long; lemmas broad, obtuse, smooth, 9-nerved, the marginal pair faint, 3½ to 4½ lines long, the hyaline margin

obtusely angled above the middle, the apex emarginate; awns 4 to 5 lines long, somewhat twisted and strongly divaricate at maturity, those of the lower florets shorter than the upper; palea conspicuously shorter than the lemma.

A weed in waste places, Washington to California and Kansas, occasional in the Eastern States, introduced from Europe and the Orient. Wrights, *Hitchcock* in 1901; Mt. Pinos, *Hall* 6368.

Refs.—Bromus japonicus Thunb. Fl. Jap. 52. 1784. *B. patulus* Mert. & Koch, Deutschl. Fl. 1: 685. 1823.

6. **B. arenarius** Labill. Culms 6 to 18 inches high; sheaths and blades pilose; panicle pyramidal, open, nodding, the spreading branches and slender pedicels sinuously curved; glumes densely pilose, acute, scarious-margined, the first narrower, 3-nerved, 4 lines long, the second 7-nerved, 5 lines long; lemmas densely pilose, 7-nerved, 5 lines long, 2-toothed at apex; awn straight, 5 to 8 lines long.

Sandy roadsides, gravelly or sterile hills; San Bernardino Mts. to Mariposa and San Mateo cos.; introduced from Australia.

Ref.—Bromus arenarius Labill. Nov. Holl. Pl. 1: 23. 1804.

7. **B. brizaeformis** Fisch. & Mey. Culms 1 to 2 feet high; sheaths and blades pilose-pubescent; panicle 2 to 6 inches long, lax, secund, nodding; spikelets oblong-ovate, laterally much compressed, 7 to 12 lines long, about 5 lines wide; glumes broad, obtuse, smooth or minutely scabrous, the first 3 to 5-nerved, about ½ the length of the broader second, the second 5 to 9-nerved, 3 to 4 lines long; lemma 5 lines long, very broad, obtuse, smooth, with a broad scarious margin, awnless or nearly so.

Sandy fields and waste ground, occasional in the Western States, rare in the Eastern States, introduced from Europe. Gazelle, *Heller* 8075; Mt. Shasta, *Palmer* 2647 in 1892.

Ref.—Bromus brizaeformis Fisch. & Mey. Ind. Hort. Petrop. 3: 30. 1836.

8. **B. scoparius** L. Culms 8 to 12 inches high; sheaths and blades more or less pilose; panicle dense, oblong or ovate, obtuse, erect, 1 to 2½ inches long; spikelets short-pediceled, 5 to 11-flowered, 5 to 9 lines long; glumes glabrous, the first 1 to 3-nerved, 2 to 2½ lines long, the second 3-nerved, 2½ to 3 lines long; lemmas 5-nerved, 3½ to 4 lines long, usually smooth, bidentate; awn somewhat divaricate, 3½ to 4 lines long.

A rare introduction from Europe. Mariposa, *Congdon* in 1892; Santa Barbara, *Somes* 6.

Ref.—Bromus scoparius L. Cent. Pl. 1: 6. 1755.

9. **B. madritensis** L. Culms tufted, 1 to 2 feet high; sheaths smooth or the lower slightly pubescent; blades puberulent or nearly smooth; panicle erect, 2 to 4 inches long, oblong-ovoid in outline, contracted and rather dense; glumes narrow, lanceolate, acuminate, the first 1-nerved, 4½ to 6 lines long, the second 3-nerved, 7 to 8 lines long; lemmas narrow, linear-lanceolate, 7 to 9 lines long, usually glabrous or merely scabrous, somewhat curved outward when old, distinctly 3 or faintly 5 to 7-nerved, with 2 acute hyaline teeth, 1 to 1½ lines long; awn rather stout, tapering, somewhat curved, 8 to 11 lines long.

Open ground and waste places, California to Oregon; introduced from Europe

Ref.—Bromus madritensis L. Cent. Pl. 1: 5. 1755.

10. **B. villosus** Forsk. Culms 1½ to 2½ feet high; sheaths and blades pilose; panicle open, rather few-flowered, 3 to 5 inches long, the lower

branches ½ to 1 inch long; spikelets usually 5 to 7-flowered, 1½ to 2 inches long; glumes smooth, narrow, acuminate, the first 7 to 10 lines long, 1-nerved, the second 12 to 15 lines long, 3-nerved; lemmas 5-nerved, 12 to 15 lines long, scabrous or puberulent, 2-toothed, the teeth 1½ to 2 lines long; awn stout, 1½ to 2 inches long.

A weed in open ground and waste places, introduced from the Mediterranean region. Common from San Francisco south, infrequent northward.

Var. **gussonei** Aschers. & Graebn. Differs in having a more open panicle, the lower branches as much as 4 or 5 inches long.—Washington to California and Arizona, introduced from southern Europe. More common than the species in middle and northern California.

Refs.—Bromus villosus Forsk. Fl. Aeg. Arab. 23. 1775. *B. maximus* Desf. Fl. Atl. 1: 95. 1798; Thurb. in Wats. Bot. Cal. 2: 319. 1880; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901. Var. gussonei Aschers. & Graebn. Syn. Mitteleur. Fl. 2: 595. 1901. *B. maximus* Desf. var. *gussonii* Parl. Fl. Ital. 1: 407. 1848; Abrams, Fl. Los Ang. 54. 1904; Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 70. 1911.

11. **B. rubens** L. Culms 6 to 15 inches high, puberulent below the panicle; sheaths and blades pubescent; panicle erect, compact, ovoid, usually purplish, 1½ to 3 inches long; spikelets 7 to 11-flowered, about 1 inch long; glumes narrow, acuminate, pubescent or sometimes smooth, the first 1-nerved, 3½ to 4½ lines long, the upper 3-nerved, 5 to 6 lines long; lemmas lanceolate, acute, 5-nerved, pubescent or smooth, 6 to 8 lines long, the apex deeply cleft into 2 long-acuminate hyaline teeth, 2 to 2½ lines long; awn straight, 9 to 11 lines long.

Dry hills and in waste or cultivated ground; common especially in middle and southern California; extends north to Washington, occasional elsewhere; introduced from southern Europe.

Refs.—Bromus rubens L. Cent. Pl. 1: 5. 1755; Thurb. in Wats. Bot. Cal. 2: 319. 1880; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901; Abrams, Fl. Los Ang. 54. 1904.

12. **B. tectorum** L. var. **nudus** Klett & Richter. Culms 1 to 2 feet high, smooth, slender; sheaths and blades pubescent; panicle broad, rather dense, drooping, 2 to 6 inches long, the branches slender; spikelets nodding, linear, becoming cuneiform in flower, 6 to 10 lines long; glumes narrow, acute, glabrous, the first 1-nerved, 2 to 3 lines long, the second 3-nerved, 4 to 5 lines long; lemmas lanceolate, acute, glabrous, 5-nerved, 5 to 6 lines long, bidentate at apex; awn straight, 6 to 7 lines long.

Along roadsides, banks and waste places, introduced from Europe. B. tectorum is introduced here and there in the U. S. but has not been observed in California; it differs in having pubescent spikelets.

Locs.—Yreka, *Butler* 474, 816, 860; Montague, *Heller* 8012; Castella, *Piper* 6337; Tahoe, *Hitchcock* 3113; Northfork, *Griffiths* 4592; Santa Barbara, *Chase* 2571.

Ref.—Bromus tectorum L. var. nudus Klett & Richter, Fl. Leipzig 109. 1830.

Division II. Perennials. Spikelets terete or somewhat compressed, not strongly flattened.

13. **B. orcuttianus** Vasey. Culms erect, leafy below, nearly naked above, 2½ to 3½ feet high, pubescent at and below the nodes; sheaths pilose or more or less velvety; blades glabrous, rather short and erect; panicle narrow-pyramidal, erect, 4 to 6 inches long, the branches few, divaricate and rather rigid in fruit; spikelets 10 to 12 lines long, subterete, on short stout pedicels; glumes narrow, smooth or scabrous, the first acute, 3 to 4 lines long, 1-nerved, or sometimes with a faint lateral pair, the second broader, obtuse, 4 to 5 lines

long, 3-nerved; lemmas 5 to 6 lines long, narrow, scabrous or scabrous-pubescent over the back, the awn 2½ to 3½ lines long.

Open woods, California to Washington.

Locs.—Modoc Co., *Baker & Nutting;* Siskiyou Co., *Butler* 469; Mt. Shasta, *Hitchcock* 2942; Mt. Sanhedrin, *Heller* 5987; Truckee River, *Sonne* 21; Tahoe, *Hitchcock* 3091; Pioneer, *Hansen* 1835; Yosemite Nat. Park, *Hall & Babcock* 3401; Pine Ridge, *Hall & Chandler* 316; Northfork, *Griffiths* 6674; S. Fork Kaweah River, *Culbertson* 4512; Santa Catalina Island, *Brandegee* 62.

Var. **hallii** Hitchc. n. var. Blades soft-pubescent on both surfaces; glumes and lemmas pubescent.—(Laminae foliorum utrinque molliter pubescentes; glumae lemmataque pubescentia.)—Dry, mostly wooded ridges and slopes, 5000 to 9000 feet, California. Type (in the National Herbarium) collected by H. M. Hall in the San Jacinto Mts., 5700 feet altitude, June 27, 1901 (no. 2301).

Locs.—Blue Cañon, Placer Co., *Kellogg* 58 in part; Kaweah River, *Coville & Funston* 1346; Santa Lucia Mts., *Davy* 7709; Tassajara Hot Springs, *Elmer* 3314; San Bernardino Mts., *Wilder* 1071, 1131; San Jacinto Mts., *Hall* 2301, *Reed* 2449; "S. Calif.", *Palmer* 233 in 1888.

Refs.—Bromus orcuttianus Vasey, Bot. Gaz. 10: 223. 1885, type from San Diego, *Orcutt* in 1884; Abrams, Fl. Los Ang. 55. 1904. *B. brachyphyllus* Merr. Rhodora 4: 146. 1902.

14 **B. grandis** Hitchc. n. comb. Culms 3 to 5 feet high; sheaths pubescent; blades pubescent, elongated, spreading, rather lax; panicle broad, open, the branches slender and drooping, naked below, the lower usually in pairs, as much as 6 inches long; first glume usually distinctly 3-nerved; lemmas densely pubescent over the back.

Dry hillsides at moderate altitudes, San Diego Co. to Madera and Monterey cos., also in Oregon and Washington.—Resembles B. orcuttianus var. hallii, from which it differs in the open drooping panicle and the more distinctly 3-nerved first glume.

Locs.—Gavilan Peak, *Brewer* 740; Northfork, *Griffiths* 6596; S. Fork Kaweah River, *Culbertson* 4512; Little Sur, *Davy* 7385; Pico Blanco, *Davy* 7339; Santa Lucia Mts., *Davy* 7691; Tassajara Hot Springs, *Elmer* 3398; Topatopa Mts., *Abrams & McGregor* 161; Mt. Wilson, *Abrams* 2600; Little Santa Anita Cañon, *Abrams* 2632; San Bernardino, *Parish* 5038; Colorado Desert, *Palmer* in 1889; La Marte, *Orcutt* 472.

Refs.—Bromus grandis Hitchc. *B. orcuttianus* Vasey var. *grandis* Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 43. 1900. *B. porteri* Nash var. *assimilans* Davy, Univ. Cal. Publ. Bot. 1: 55. 1902, type *Hall* 2228 from San Jacinto Mts.

15. **B. vulgaris** Shear. Culms 3 to 4 feet high, the nodes pubescent; sheaths pilose; blades scattered, more or less pilose; panicle open, 4 to 6 inches long, the branches slender and drooping; spikelets slender, about an inch long; glumes narrow, sparsely pubescent, the first 1-nerved, 2½ to 4 lines long, acute, the second 3-nerved, broader and longer than the first, obtuse or acutish; lemmas 4 to 5 lines long, sparsely pubescent over back, pubescent or ciliate near the margins or nearly glabrous; awn 3 to 4 lines long.

Rocky woods and shady ravines, to 7000 feet, California to Vancouver and Montana.

Locs.—Humboldt Bay, *Chandler* 1177; Hubbard Sta., *Davy & Blasdale* 5406; Sherwood, *Hitchcock* 2700, 2708; Pt. Reyes, *Davy* 6853; Mill Valley, *Davy* 4126; Calaveras Co., *Hillebrand* 2258; Berkeley Hills, *Chase* 5668; Congress Springs, *Hitchcock* 2660; Santa Cruz, *Jones;* Santa Cruz Island, *Brandegee* 70; San Bernardino Mts., *Abrams* 2851.

Var. **eximius** Shear. Sheaths glabrous.—Moist mountain sides, British Columbia to California. Sherwood Valley, *Davy & Blasdale* 5226; Mendocino plains, *Bolander* 4753.

Refs.—Bromus vulgaris Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 43. 1900. *B. purgans* L. var. *vulgaris* Hook. Fl. Bor. Am. 2: 252. 1840. *B. ciliatus* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 320. 1880. Var. eximius Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 44. 1900.

16. **B. laevipes** Shear. Culms 2½ to 3 feet high, the base often decumbent and rooting; sheaths and blades glabrous; panicle broad, lax, drooping, 6 to 8 inches long, the branches slender, drooping; glumes smooth, the first 3-nerved, 3 to 4 lines long, the second 5-nerved, 5 to 6 lines long; lemmas obtuse, 7-nerved, 6 to 7 lines long, densely pubescent on the margin nearly to the apex and on the back at the base; awn 1½ to 2½ lines long.

Moist woods and shady banks, in the Coast Ranges from Humboldt Co. to San Diego; in Shasta and Lassen cos., and in the middle Sierra Nevada; extends north to Washington.

Refs.—BROMUS LAEVIPES Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 45. 1900; Davy in Jepson, Fl. W. Mid. Cal. 71. 1901. *B. richardsoni* [Link, misapplied by] Abrams, Fl. Los Ang. 55. 1904.

17. **B. suksdorfii** Vasey. Culms 2 to 3 feet high; sheaths and blades smooth, scattered; panicle narrow, erect, rather dense, 3 to 5 inches long, the branches erect or ascending; spikelets about an inch long, longer than the pedicels; glumes glabrous, the first 1-nerved, 4 to 5 lines long, the second 3-nerved, 5 to 6 lines long; lemmas 6 to 7 lines long, appressed-pubescent near margin and on the lower part of the midnerve.

Rocky woods and slopes, California to Washington.

Locs.—Donner Lake, *Heller* 7120; Mt. Tallac, *Hitchcock* 3131; Yosemite Nat. Park, *Hitchcock* 3303; Ebbetts Pass, *Brewer* 2088; Sequoia Nat. Park, *Hitchcock* 3365.

Ref.—BROMUS SUKSDORFII Vasey, Bot. Gaz. 10: 223. 1885.

DIVISION III. Annuals or perennials; spikelets large, strongly flattened, usually keeled; lemmas acuminate, usually awned.

18. **B. unioloides** H.B.K. RESCUE GRASS. Annual; culms 2 to 3 feet high; sheaths pilose; blades narrow, very scabrous; panicle open; spikelets about an inch long, 2½ to 4½ lines broad; glumes smooth, the first 5-nerved, 3½ to 5 lines long, the second 7-nerved, 5 to 6 lines long; lemmas acute, subcoriaceous, glabrous or scabrous, 6 to 8 lines long; awn 1 line long or less; palea ½ to ¾ as long as lemma.

Native country not certainly known, but probably the Andes, now distributed from Chile to southern U. S. Cultivated as a meadow grass in the Southern States under the name of Rescue Grass and Schrader's Brome Grass. Introduced in California.

Locs.—Palo Alto, *Congdon;* Bishop, *Heller* 8251; Kern Co., *Lockenby;* Pasadena, *Hitchcock* 2550; Fruitland, *Abrams* 1461; San Bernardino, *Parish* 4672; Mentone, *Leiberg* 3296.

Refs.—BROMUS UNIOLOIDES H.B.K. Nov. Gen. & Sp. 1: 151. 1816; Thurb. in Wats. Bot. Cal. 2: 322. 1880; Abrams, Fl. Los Ang. 56. 1904. Var. *haenkeanus* Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 52. 1900; Abrams, Fl. Los Ang. 56. 1904. *Ceratochloa haenkeana* Presl, Rel. Haenk. 1: 285. 1830.

19. **B. subvelutinus** Shear. Perennial; culms 1 to 2 feet high; sheaths canescent; blades narrow, rather rigid, becoming involute, canescent and also pilose; panicle 2 to 4 inches long, narrow, erect, the branches short, erect; spikelets about an inch long; glumes pubernlent, the first 3 to 5-nerved, 4 to 5 lines long, the second 7-nerved, 5 to 6 lines long; lemmas appressed-pubernlent, 6 to 7 lines long; awn 1½ to 2 lines long.

Dry wooded hills and meadows, California to Oregon and Wyoming.

Locs.—Goosenest Mt., *Butler* 842; Warner Mts., *Griffiths & Hunter* 399; N. E. Shasta Co., *Hall & Babcock* 4196; Eureka, *Davy;* East Oakland, *Davy;* Templeton, *Davy* 7587; Ft. Tejon, *Parish* 1995; Mt. Pinos, *Hall* 6635; San Bernardino Mts., *Hall* 7601; Laguna, *Schoenfeldt* 3624.

Ref.—BROMUS SUBVELUTINUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 52. 1900.

20. **B. marginatus** Nees. Short-lived perennial; culms rather stout, 2 to 4 feet high; sheaths pilose; blades broad, flat, more or less pilose; panicle erect, rather narrow, 4 to 8 inches long, the lower branches erect or somewhat spreading; spikelets 1 to 1½ inches long, 2½ to 3½ lines wide, 7 or 8-flowered; glumes broad, scabrous, or scabrous-pubescent, the first subacute, 3 to 5-nerved, 3½ to 4½ lines long, the second obtuse, 5 to 7-nerved, 4½ to 5½ lines long; lemmas subcoriaceous, coarsely pubescent, ovate-lanceolate, acute, 5½ to 7 lines long; awn 2 to 3½ lines long.

Open ground, open woods, roadsides and waste places, Riverside Co. to British Columbia, east to Alberta and Arizona.

Var. **seminudus** Shear. Sheaths glabrous; plant often tall and stout with large spreading panicle.—Woods or near streams, mostly from 3000 to 9000 feet altitude. San Jacinto Mts. (*Hall* 785) north to British Columbia and east to Assiniboia and Colorado.

Refs.—BROMUS MARGINATUS Nees; Steud. Syn. Pl. Glum. 1: 322. 1854; Davy in Jepson, Fl. W. Mid. Cal. 72. 1901; Abrams, Fl. Los Ang. 56. 1904. *Ceratochloa breviaristata* [Hook. misapplied by] Thurb. in Wats. Bot. Cal. 2: 321. 1880. Var. SEMINUDUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 55. 1900.

21. **B. maritimus** Hitchc. n. comb. Differs from B. marginatus in having smooth sheaths, scabrous but not pilose blades, and narrow, strict panicle, the branches short and erect.

Near the coast from Sonoma Co. to Monterey Co.

Loes.—Bodega Pt., *Eastwood;* Pt. Reyes, *Davy* 6760, 6798, 6844; San Francisco, *Jones* 3270, *Lemmon, Michener & Bioletti;* Monterey, *Davy* 7281; Little Sur, *Davy* 7406.

Refs.—BROMUS MARITIMUS Hitchc. *B. marginatus* Nees var. *maritimus* Piper, Proc. Biol. Soc. Wash. 17: 148. 1905.

22. **B. carinatus** H. & A. Annual; culms 2 to 3 feet high; sheaths pilose; blades narrow, flat, more or less pilose; panicle pyramidal, rather lax, the lower branches spreading or drooping; spikelets about an inch long, 2½ lines wide, 5 to 9-flowered; glumes lanceolate, acute, glabrous or slightly scabrous-pubescent, the first 3-nerved, 3½ to 4½ lines long, the second 5-nerved, 4½ to 5½ lines long; lemmas lanceolate, puberulent or short-pubescent, 6½ to 8 lines long; awn 3½ to 5 lines long.

Open ground, open woods, roadsides and waste places, throughout the state, north to Washington.

Var. **californicus** Shear. Sheaths smooth; spikelets narrower than in the species.—Common in the Coast Ranges; infrequent in the Sierra Nevada and San Bernardino Mts.

Var. **hookerianus** Shear. Sheaths smooth; spikelets as broad as in the species.—Range about as in the last, less common.

Var. **linearis** Shear. Sheaths pubescent; blades very narrow, less than 1 line wide; panicle narrow, few-flowered.—Known only from California. Berkeley Hills, *Davy* 4245; above timber-line, Mt. Lyell, *Hitchcock* 3330.

Refs.—BROMUS CARINATUS H. & A. Bot. Beech. 403. 1841; Davy in Jepson, Fl. W. Mid. Cal. 72. 1901; Abrams, Fl. Los Ang. 56. 1904. Var. CALIFORNICUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 60. 1900. Var. HOOKERIANUS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 60. 1900. *B. hookerianus* Thurb. in Wilkes, U. S. Expl. Exped. 17²: 493. 1874; Davy in Jepson, Fl. W. Mid. Cal. ed. 2. 71. 1911. *Ceratochloa grandiflora* Hook. Fl. Bor. Am. 2: 253. 1840; Thurb. in Wats. Bot. Cal. 2: 321. 1880. Var. LINEARIS Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 61. 1900, type from California (without locality), *G. R. Vasey* in 1875

Tribe IX. HORDEAE.

63. **LOLIUM** L.

Spikelets several-flowered, solitary at each node of a continuous rachis, 1 edge of each spikelet placed against the rachis, the glume on that edge (the first glume) wanting, but both glumes present on the terminal spikelet. Glume narrow, rigid, 5 to 7-nerved, longer than the lower lemma, often exceeding the uppermost. Lemmas convex, 5 to 7-nerved, awned or awnless. Annuals or short-lived perennials with flat blades and spikelets scattered in terminal spikes.—Species 6, temperate Eurasia, introduced in America. (An ancient Latin name.)

Glume shorter than the spikelet.
Lemmas awned ..... 1. *L. multiflorum.*
Lemmas nearly or quite awnless ..... 2. *L. perenne.*
Glume as long or longer than the spikelet; annuals.
Spikelets conspicuous ..... 3. *L. temulentum.*
Spikelets hidden behind the appressed glumes ..... 4. *L. subulatum.*

1. **L. multiflorum** Lam. Italian Rye-grass. Australian Rye-grass. Short-lived perennial; culms 1 to 2 feet high, erect or often decumbent at base, often rough below the spike and on the convex portion of the rachis; spike as much as a foot long; spikelets as much as an inch long, twice as long as glume, 10 to 20-flowered; lemmas 3½ to 4 lines long, at least the upper awned.

Roadsides and waste places, mostly in the Coast Ranges; introduced from Europe, common on the Pacific Coast and frequent in the Eastern States. Frequently cultivated for lawns and as a meadow or pasture grass.

Refs.—Lolium multiflorum Lam. Fl. Franç. 621. 1778. *L. italicum* A. Br. Flora 17: 241. 1834; Thurb. in Wats. Bot. Cal. 2: 323. 1880. *L. perenne* L. var. *italicum* Parn. Grasses Brit. 298. 1845; Davy in Jepson, Fl. W. Mid. Cal. 75. 1901. Var. *multiflorum* "auct." [Parn.] Davy in Jepson, Fl. W. Mid. Cal. 75. 1901; Abrams, Fl. Los Ang. 58. 1904.

2. **L. perenne** L. Perennial Rye-grass. Resembling L. multiflorum, but usually more delicate, with narrower blades and smaller spikes; culm and convex surface of rachis smooth; spikelets usually 8 to 10-flowered, not much exceeding the glume; lemmas smaller, awnless.

Roadsides and waste places, throughout the cooler and moister portion of the U. S. Introduced from Europe. Sometimes cultivated as a lawn or pasture grass. Rare on the Pacific Coast.

Locs.—Mt. Shasta, *Palmer* 2639 in 1892; Ferndale, *Davy* 6200; Mendocino Co., *McMurphy* 421; Fresno Co., *Griffiths* 4712.

Var. **tenue** Kunth. Blades narrow, folded, firm, erect; spikes slender, the spikelets few-flowered.—Yreka, *Butler* 1563; near Mt. Shasta, *Palmer* 2612 in 1892.

Refs.—Lolium perenne L. Sp. Pl. 83. 1753; Thurb. in Wats. Bot. Cal. 2: 323. 1880; Davy in Jepson, Fl. W. Mid. Cal. 75. 1901; Abrams, Fl. Los Ang. 57. 1904. Var. tenue Kunth, Enum. 1: 436. 1833; Davy in Jepson, Fl. W. Mid. Cal. 75. 1901.

3. **L. temulentum** L. Darnel. Annual; culms 2 to 3 feet high; spike stout and strict, 6 to 8 inches long; glume about 1 inch long, as long or longer than the 5 to 7-flowered spikelet, firm, pointed; lemmas as much as 4 lines long, obtuse, awned; awn as much as 4 lines long.

Fields and waste places, rather common throughout the state and northward along the Pacific Coast, rare in the Eastern States; introduced from Europe.

Var. **arvense** Bab. Differs in having awnless spikelets.—Less common than the species, introduced from Europe.

Locs.—Hupa Valley, *Davy* 5690; Norman, *Davy* 4293; Yosemite Valley, *Hitchcock;* Ojai Valley, *Hubby* 52; Inglewood, *Abrams* 1183; Pasadena, *Hitchcock* 2555; San Bernardino, *Canby* 675; The Needles, *Jones;* San Diego, *Brandegee* 135.

Refs.—Lolium temulentum L. Sp. Pl. 83. 1753; Thurb. in Wats. Bot. Cal. 2: 323. 1880; Davy in Jepson, Fl. W. Mid. Cal. 75: 1901; Abrams, Fl. Los Ang. 58. 1904. Var. arvense Bab. Man. Brit. Bot. 377. 1843. *L. arvense* With. Arr. Brit. Pl. ed. 3. 2: 168. 1796.

4. **L. subulatum** Vis. Annual; culms bushy-branched at base, stiffly spreading or prostrate; sheaths and blades smooth; spike stout, rigid, often curved; spikelets partially sunken in the excavations of the rachis and partially hidden by the appressed obtuse, strongly nerved glumes; lemmas 2½ lines long.

Introduced from Europe; rare. West Berkeley, *Pendleton* 449.

Ref.—Lolium subulatum Vis. Fl. Dalm. 1: 90. 1842.

64. **MONERMA** Beauv.

Spikelets 1-flowered, solitary, imbedded in the joints of an articulated rachis, forming a slender cylindrical spike, and placed with the floret dorsi-ventral to the rachis as in Lolium. Glume of lateral spikelets solitary, coriaceous, gradually acuminate, longer than the lemma, the terminal spikelet with two glumes. Lemma membranaceous. Low cespitose annuals.—Species 3, of the Old World, 1 introduced in California. (Greek monos, single, and erma, support, on account of the single glume.)

1. **M. cylindrica** Coss. & Dur. Culms bushy-branched, spreading or prostrate, 4 to 12 inches long; spike cylindrical, curved, narrowed upward; glume 3 lines long, acuminate; lemmas 2½ lines long, pointed, scarious.

Salt marshes, San Francisco Bay south to San Diego; introduced from Europe.

Locs.—Pinole Creek Valley, *Davy* 6653; Ballona River, *Abrams* 2567; Oceanside, *Parish* 4446; San Diego, *Orcutt*.

Refs.—Monerma cylindrica Coss. & Dur. Expl. Algér. 2: 214. 1867. *Lepturus cylindricus* Trin. Fund. Agrost. 123. 1820; Davy in Jepson, Fl. W. Mid. Cal. 73. 1901; Abrams, Fl. Los Ang. 58. 1904. *Rottboellia cylindrica* Willd. Sp. Pl. 1: 464. 1797.

65. **LEPTURUS** R. Br.

Spikelets 1 or 2-flowered, solitary at the nodes, embedded in the articulated rachis. Glumes 2, placed in front of the spikelet and enclosing it, coriaceous, 5-nerved, acute, unsymmetrical, appearing like halves of a single split glume. Lemmas much smaller than the glumes, hyaline, keeled. Low annuals with slender spikes.—Species 5 or 6, eastern hemisphere, 1 introduced in California. (Greek leptos, slender, and oura, tail.)

1. **L. incurvatus** Trin. Culms tufted, decumbent at base, 4 to 8 inches high; blades short and narrow; spike 3 to 4 inches long, cylindrical, curved; spikelets 3½ lines long, pointed.

Mudflats and salt marshes, Marin Co. to San Diego; also adventive on ballast on the Atlantic Coast. Introduced from Europe.

Locs.—Pt. Reyes, *Davy* 6774; Martinez, *Davy* 6674; Santa Barbara, *Hitchcock* 2560; Ventura, *Chase* 5588; Santa Catalina Island, *Brandegee* 54; Old Town, *Abrams* 3544.

Refs.—Lepturus incurvatus Trin. Fund. Agrost. 123. 1820; Davy in Jepson, Fl. W. Mid. Cal. 73. 1901; Abrams, Fl. Los Ang. 58. 1904.

66. **SCRIBNERIA** Hack.

Spikelets 1-flowered, solitary or in pairs, sessile, placed with the floret lateral to the continuous rachis, forming slender spikes. Glumes 2, narrow, rigid, acute, slightly unequal, strongly keeled. Rachilla prolonged behind the floret as a very short stipe. Lemma shorter than the glumes, membranaceous, keeled,

2-toothed at apex, awned between the teeth, the callus hairy. Palea equaling or exceeding the lemma, acutely 2-toothed. A low slender annual with short narrow blades and slender spikes.—Species 1, California to Washington. (Prof. F. Lamson-Scribner, an eminent American agrostologist.)

1. **S. bolanderi** Hack. Culms 3 to 12 inches high, tufted, erect or ascending; spike slender, about ½ line thick, the joints 2 to 3 lines long.

Sandy or sterile ground, in the mountains, California to Washington; rare.

Loes.—Bigoak Flat, Tuolumne Co., *Congdon;* Wawona to Yosemite, *Chase* 5707; Mariposa, *Congdon;* Northfork, *Griffiths* 4585, 4600; Dunlap to Millwood, *Griffiths* 4659.

Refs.—SCRIBNERIA BOLANDERI Hack. Bot. Gaz. 11: 105. 1886; Davy in Jepson, Fl. W. Mid. Cal. 74. 1901. *Lepturus bolanderi* Thurb. in Wats. Bot. Cal. 2: 322. 1880, type from Russian River, *Bolander* 4669.

67. **AGROPYRON** Gaertn.

Spikelets several-flowered, solitary (or rarely in pairs), sessile, placed flatwise at each joint of the raehis, forming spikes. Glumes equal, firm, several-nerved, usually shorter than the spikelet, usually acute or awned. Lemmas convex, rather firm, 5 to 7-nerved, usually acute or awned from apex. Perennials.—Species about 35, in all temperate regions. (Greek agros, a field, and puros, wheat.)

Plants producing rhizomes.
  Lemmas scabrous-pubescent ..... 4. *A. subvillosum.*
  Lemmas glabrous.
    Blades thin and flat, sparsely hairy above ..... 2. *A. repens.*
    Blades involute in drying, firm, glabrous.
      Glumes obtuse ..... 1. *A. junceum.*
      Glumes acuminate ..... 3. *A. smithii.*
Plants not producing rhizomes.
  Awn of lemma short or wanting.
    Nodes pubescent; spikelets distant ..... 5. *A. parishii.*
    Nodes glabrous; spikelets approximate ..... 7. *A. tenerum.*
  Awn of lemma as long as body or longer.
    Awn straight or slightly spreading.
      Glumes awned; spikelets approximate ..... 8. *A. caninum.*
      Glumes unawned; spikelets rather distant.
        Glumes obtuse or notched; plant more than 3 feet tall ..... 6. *A. laeve.*
        Glumes acute; plant less than 3 feet tall ..... 9. *A. vaseyi.*
    Awn widely spreading or recurved.
      Glumes acute, awnless ..... 10. *A. scabrum.*
      Glumes awned.
        Glumes 2-nerved, the awns long and recurved; axis readily disarticulating.
          Culms erect ..... 11. *A. flexuosum.*
          Culms ascending or spreading ..... 12. *A. scribneri.*
        Glumes 3 to 5-nerved, the awns short, straight; axis not disarticulating ..... 13. *A. pringlei.*

1. **A. junceum** Beauv. Culms 1 to 2 feet high, decumbent at base, producing creeping rhizomes; blades involute, firm, smooth below; spike stout, easily disarticulating at the joints; spikelets compressed, smooth, 8 to 15 lines long; glumes oblong, obtuse, rather faintly many-nerved; lemmas obtuse, awnless, the midrib sometimes extending as a point.

Sandy sea-coast of Europe and North Africa. The only specimen from California was collected at the outlet of Lake Merced, near San Francisco, by J. W. Congdon. This is the form with large spikelets about 1 inch long (β macrostachyum Lange), which however is scarcely worthy of varietal rank.

Refs.—AGROPYRON JUNCEUM Beauv. Ess. Agrost. 102, 146. 1812. *Triticum junceum* L. Mant. 2: 327. 1771.

2. **A. repens** Beauv. QUACK-GRASS. Culms 1 to 4 feet high, from a bright yellow-green creeping scaly rhizome; blades thin, flat, sparsely pilose above; spike 2 to 6 inches long; spikelets about 5-flowered, 5 to 7 lines long; glumes 4 to 5 lines long, acuminate or awn-pointed, strongly nerved; lemmas 5 lines long, glabrous or scabrous, strongly nerved, pointed or awned.

A common and troublesome weed in the eastern U. S., rare on the Pacific coast; introduced from Europe. San Francisco in gardens, *Bolander* 1510.

Refs.—AGROPYRON REPENS Beauv. Ess. Agrost. 102, 146. 1812. *Triticum repens* L. Sp. Pl. 86. 1753; Thurb. in Wats. Bot. Cal. 2: 323. 1880. *Agropyron richardsoni* [Schrad. misapplied by] Davy in Jepson, Fl. W. Mid. Cal. 76. 1901.

3. **A. smithii** Rydb. Plant usually glaucous, from gray or tawny creeping scaly rhizomes; culms 1 to 5 feet high, rigid; blades bluish green, scabrous, firm, striate, becoming involute; spikelets 7 to 13-flowered, somewhat distant, glabrous or nearly so, acute, compressed, divergent, sometimes in pairs; glumes acuminate, ½ to ⅔ as long as spikelet, the nerves usually faint; lemmas mucronate or awn-pointed, hard, faintly nerved.

Dry, especially alkaline soil; Modoc Co. (Smoke Creek, *Griffiths & Hunter* 489) north to Vancouver Island and east to Michigan and Kansas.

Refs.—AGROPYRON SMITHII Rydb. Mem. N. Y. Bot. Gard. 1: 64. Feb. 1900. *A. occidentale* Scribn. U. S. Dept. Agr. Div. Agrost. Circ. 27: 9. Dec. 1900.

4. **A. subvillosum** E. Nels. Culms 1½ to 3 feet high, from creeping rhizomes; blades narrow, mostly involute, scabrous; spike erect, 2 to 5 inches long; spikelets few-flowered, about ½ inch long; glumes lanceolate, the first narrow, 3 to 5-nerved, 4 lines long, the second broader, 5 to 7-nerved, 4½ lines long; lemmas 4 to 5 lines long, more or less scabrous-pubescent, acute or awn-pointed.

Lassen Co. (mountains south of Dixie Valley, *Baker & Nutting* in 1894) north to Washington and east to Saskatchewan and Colorado.

Refs.—AGROPYRON SUBVILLOSUM E. Nels. Bot. Gaz. 38: 378. 1904. *Triticum repens* L. var. *subvillosum* Hook. Fl. Bor. Am. 2: 254. 1840.

5. **A. parishii** Scribn. & Smith. Culms 3 to 4 feet high, without rhizomes, the nodes pubescent; blades flat; spike narrow, as much as foot long; spikelets narrow, distant, mostly shorter than the internodes of the rachis, about ¾ inch long; glumes about 8 lines long, several-nerved, acute, more than ½ as long as spikelet; lemmas smooth, faintly nerved, short-awned or awn-pointed.

Only known from California. Pico Blanco, Monterey Co., *Davy* 7364; San Bernardino Mts., *Parish* 2054, 2238, 4180.

Refs.—AGROPYRON PARISHII Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 28. 1897, type *Parish* 2054; Abrams, Fl. Los Ang. 59. 1904.

6. **A. laeve** Hitchc. n. comb. Culms 4 to 5 feet high, without rhizomes; blades flat; spike as much as a foot long; spikelets distant, usually shorter than the internodes of the rachis; glumes obtuse, several-nerved, about 5 lines long; lemmas about 5 lines long, long-awned; awn ½ to 1 inch long.

Only known from California. Clinton, *Hansen* 1767; Dunlap to Millwood, *Griffiths* 4686; "Ex. Herb. State Normal School, San Jose, *Norton* in 1879."

Refs.—AGROPYRON LAEVE Hitchc. *A. parishii* Scribn. & Smith var. *laeve* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 28. 1897, type *Palmer* 414 in Gray Herbarium collected in 1875 at Fowley's, Cuyamaca Mts.; Abrams, Fl. Los Ang. 59. 1904.

7. **A. tenerum** Vasey. Culms erect, tufted, 2 to 4 feet high, without rhizomes; blades narrow, flat or involute; spike cylindrical, slender, erect, 4 to

6 inches long; glumes firm, nearly as long as the spikelet, gradually tapering into an awned point; lemmas short-awned.

Open woods, rocky slopes and upland plains, in the region of Mt. Shasta, in the Sierra Nevada and in the southern mountains; also in Yolo Co. (*Blankinship* 43) and San Mateo Co. (*Bolander* 1512); extends north to Alaska and east to Labrador and New England. The following specimens have thicker spikes with more imbricated spikelets, the form (var. longifolium) to which the name A. pseudorepens has sometimes been misapplied: Woodland, *Blankinship* 43; Yreka, *Butler* 850; San Bernardino Mts., *Hall* 7659; Mt. Pinos, *Hall* 6418.

Refs.—AGROPYRON TENERUM Vasey, Bot. Gaz. 10: 258. 1885; Davy in Jepson, Fl. W. Mid. Cal. 76. 1901. Var. *longifolium* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 30. 1897. *Triticum violaceum* [Hornem. misapplied by] Thurb. in Wats. Bot. Cal. 2: 324. 1880. *Agropyron caninum* L. var. *tenerum* Pease & Moore, Rhodora 12: 71. 1910.

8. **A. caninum** Beauv. Culms erect, 1 to 3 feet high, without rhizomes; blades flat, rather lax, 1 to 3 lines wide, scabrous; spike more or less nodding at apex, rather dense, 3 to 6 inches long; spikelets 6 to 7 lines long; glumes pointed or awned; lemmas 3 to 5-nerved; awn straight, or somewhat spreading, once or twice the length of the lemma.

Dry hillsides and mountain meadows, in the Sierra Nevada and southern mountains, also in the Santa Lucia Mts. (*Davy* 7647, 7713); extends east to Colorado and north to Alaska and Greenland.

Refs.—AGROPYRON CANINUM Beauv. Ess. Agrost. 102. 1812. *Triticum caninum* L. Sp. Pl. 86. 1753; Thurb. in Wats. Bot. Cal. 2: 324. 1880.

9. **A. vaseyi** Scribn. & Smith. Culms slender, 2 to 3 feet high, without rhizomes; blades narrow, involute, erect, smooth; spike slender, 2 to 4 inches long; spikelets rather distant, 5 to 8 lines long; glumes 3 to 5 lines long, acute, but not awned, thin, scarious at margin and tip, strongly 3 to 5-nerved; lemmas faintly nerved, terminating in a slender, finally horizontally spreading awn as much as $\frac{3}{4}$ inch long.

Rocky or arid hillsides, northeastern California to Alberta, Montana and New Mexico.

Loes.—Klamathon, *Copeland* 3542; Forestdale, *Baker & Nutting, Davy;* Warner Mts., *Griffiths & Hunter* 464; Modoc Nat. For., *Hatton* 150; Jess Valley to Blue Lake, Modoc Co., *Griffiths & Hunter* 402; Dixie Mts., *Baker & Nutting;* Amedee, *Davy.*

Refs.—AGROPYRON VASEYI Scribn. & Smith U. S. Dept. Agr. Div. Agrost. Bull. 4: 27. 1897. *Triticum strigosum* [Lessing, misapplied by] Thurb. in Wats. Bot. Cal. 2: 324. 1880. The specimen in the Gray Herbarium described by Thurber was collected by J. G. Lemmon in "Sierra, Nevada Co."

10. **A. scabrum** Beauv. Culms 3 to 4 feet high, without rhizomes; blades flat; spike 6 to 8 inches long; spikelets rather distant, about $\frac{3}{4}$ inch long; glumes about $\frac{1}{2}$ inch long, about 7-nerved, short-awned; lemmas about $\frac{1}{2}$ inch long, faintly nerved, terminating in a long stout spreading awn as much as $1\frac{1}{2}$ inches long.

The only specimen seen is Bolander's no. 6468, collected south side of Eel Ridge. It agrees fairly well with a specimen from Hunter's River, New South Wales, collected by the Wilkes Expedition, but differs from most of the Australian specimens of A. scabrum in having longer glumes. It resembles A. arizonicum Scribn. & Smith, which, however, has shorter glumes. The California specimen is tentatively referred to the Australian A. scabrum until the species can be more thoroughly studied.

Refs.—AGROPYRON SCABRUM Beauv. Ess. Agrost. 102. 1812; Davy in Jepson, Fl. W. Mid. Cal. 76. 1901. *Triticum scabrum* R. Br. Prodr. 178. 1810. *Festuca scabra* Labill. Nov. Holl. Pl. 1: 22. 1804.

11. **A. flexuosum** Piper. Culms 2 to 3 feet high, slender, without rhizomes; sheaths smooth; blades short, flat or loosely involute; spike 3 to 4 inches long, flexuous, long-exserted, the rachis disarticulating; spikelets sometimes in pairs; glumes subulate or narrowly lanceolate, mostly 2-nerved, narrowed into a slender spreading awn ½ to 1 inch long; lemmas 4 lines long, smooth and rounded below, 5-nerved and somewhat scabrous above, tipped with a slender spreading awn about an inch long.

Mountain slopes, Modoc Co. (Warner Mts., *Griffiths & Hunter* 468) to Washington and Idaho.

Refs.—AGROPYRON FLEXUOSUM Piper, Proc. Biol. Soc. Wash. 18: 149. 1905. *Sitanion flexuosum* Piper, Erythea 7: 99. 1899.

12. **A. scribneri** Vasey. Culms ascending or spreading, ½ to 1½ feet high; blades short, flat, rather thin, mostly basal; spike short and thick, 1 to 2 inches long, readily disarticulating at the joints; spikelets rather closely imbricated, somewhat divergent, about 5 lines long, few-flowered; glumes narrow, rigid, 2-nerved, gradually narrowed into a horizontally spreading awn ½ to ¾ inch long; lemmas nerved toward tip, terminating in awns similar to those of the glumes but somewhat longer.

Rocky slopes, mostly above 9000 feet, Mt. Dana (*Congdon* in 1898) to Montana and south to Arizona and New Mexico.

Ref.—AGROPYRON SCRIBNERI Vasey, Bull. Torr. Club 10: 128. 1883.

13. **A. pringlei** Hitchc. n. comb. Culms 1 to 1½ feet high; blades usually flat, short; spike 2 to 4 inches long, not disarticulating, the spikelets falling from the rachis; glumes lanceolate, 3 to 5-nerved, ending in a short straight awn; lemmas ending in stout horizontally spreading awns about ¾ inch long.

Gravelly slides and rocky slopes at 7000 to 12,000 feet elevation in the Sierra Nevada; also in Wyoming.

Locs.—Webber Lake, *Leiberg* 5244; Carson Pass, *Brewer* 2118; Mt. Tallac, *Hitchcock* 3152; Pyramid Peak, *Hall & Chandler* 4718; Sequoia Nat. Park, *Hitchcock* 3385; Little Kern River, *Purpus* 5515.

Refs.—AGROPYRON PRINGLEI Hitchc. *A. gmelini* Scribn. & Smith var. *pringlei* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 31. 1897, type from above Summit Valley, *Pringle*.

68. HORDEUM L. WILD BARLEY.

Spikelets 1-flowered, 3 together at each joint of the rachis, the middle one sessile and perfect, the lateral usually pediceled, often reduced to awns. Glumes equal, rigid, narrow-lanceolate, subulate or setaceous, usually elongated and awn-like, the 3 pairs simulating an involucre around the central perfect floret. Rachilla prolonged behind the palea as an awn, sometimes with a rudimentary floret. Lemma of central floret obscurely 5-nerved, tapering into an awn. Palea with its back toward the rachis. Cespitose annuals or perennials with dense terminal bristly spikes disarticulating at maturity, the joints falling with the spikelets attached.—Species about 16, temperate regions of both hemispheres. (The ancient Latin name for barley.)

Plants perennial; awns as much as 2 inches long ..... 1. *H. jubatum.*
Plants annual.
  Glumes or some of them ciliate ..... 5. *H. murinum.*
  Glumes not ciliate.
    Glumes of fertile spikelet dilated above the base ..... 2. *H. pusillum.*
    Glumes not dilated.
      Glumes very scabrous ..... 3. *H. nodosum.*
      Glumes glabrous or minutely scabrous ..... 4. *H. gussoneanum.*

1. **H. jubatum** L. Perennial; culms erect, or decumbent at base, 1 to 2 feet high; blades 2½ lines wide, scabrous; spike nodding, 2 to 4 inches long, about an inch wide, soft; lateral pair of spikelets each reduced to 1 to 3 spreading awns; glumes of perfect spikelets awn-like, 1 to 2½ inches long, spreading; lemma 3 to 4 lines long with an awn as long as the glumes.

Open ground, fields and waste places, north to Alaska and east to Ontario and Kansas; often a troublesome weed in alfalfa fields in the Rocky Mountain region.

Locs.—Honey Lake Valley, *Davy* 3299; Suisun marshes, *Davy* 4118; Lancaster, *Elmer* 3518; San Bernardino Mts., *Parish Bros.* 1540.

Refs.—HORDEUM JUBATUM L. Sp. Pl. 85. 1753; Thurb. in Wats. Bot. Cal. 2: 325. 1880.

2. **H. pusillum** Nutt. Annual; culms 4 to 15 inches high; blades erect, flat; spike erect, 1 to 3 inches long, 5 to 7 lines wide; lateral pair of spikelets abortive, the first glume of each and both glumes of the fertile spikelet dilated above the base, attenuate into a slender awn 4 to 7 lines long; glumes very scabrous; lemma unawned.

Plains and open, especially alkaline ground; San Diego, *Baker* 3682, *Orcutt* 1175; Santa Catalina Island, *Trask;* north to Idaho and eastward to Ohio.

Ref.—HORDEUM PUSILLUM Nutt. Gen. Pl. 1: 87. 1818.

3. **H. nodosum** L. Similar to H. pusillum, but usually taller; all the glumes awn-like.

Fields, waste places, and open ground throughout the state, north to Alaska and east to Indiana; introduced from Eurasia and abundantly naturalized.

Refs.—HORDEUM NODOSUM L. Sp. Pl. ed. 2. 1: 126. 1762; Thurb. in Wats. Bot. Cal. 2: 325. 1880; Davy in Jepson, Fl. W. Mid. Cal. 82. 1901; Abrams, Fl. Los Ang. 60. 1904. Var. *depressum* Scribn. & Smith, U. S. Dept. Agr. Div. Agrost. Bull. 4: 24. 1897; Abrams, Fl. Los Ang. 60. 1904.

4. **H. gussoneanum** Parl. Annual; culms numerous, spreading or geniculate at base, 6 to 15 inches high; sheaths and flat blades, especially the lower, more or less pubescent; spike erect, oblong, ½ to 1½ inches long, 3 to 5 lines wide, rounded at base; glumes setaceous, glabrous or minutely scabrous, about ½ inch long; lemma of lateral spikelets small, narrowed into an awn about 1½ lines long; lemma of central spikelet 2½ lines long, the awn somewhat longer than the glumes.

Fields and waste places, common, north to Vancouver Island and east to Idaho; introduced from Europe.

Refs.—HORDEUM GUSSONEANUM Parl. Fl. Palerm. 1: 246. 1845; Abrams, Fl. Los Ang. 60. 1904. *H. maritimum* With. var. *gussoneanum* Richt. Pl. Eur. 1: 131. 1890; Davy in Jepson, Fl. W. Mid. Cal. 83. 1901. *H. maritimum* With. is mentioned by Abrams as growing along the coast at San Diego (Fl. Los Ang. 60. 1904).

5. **H. murinum** L. Annual; culms bushy-branched, spreading; sheaths and blades smooth; spike 2 to 3 inches long, often partially enclosed by the uppermost inflated sheath; glumes of the central spikelet narrowly spindle-form, 3-nerved, long-ciliate on both margins, the nerves scabrous; awn about an inch long; glumes of the lateral spikelets unlike, the inner similar to the central, the outer setaceous, not ciliate; lemmas all broad, 4 to 5 lines long, the awns somewhat exceeding those of the glumes.

Fields, waste places, and open ground, throughout the state, north to Vancouver Island and east to Idaho and New Mexico, rare in the Eastern States; introduced from Europe.

Refs.—HORDEUM MURINUM L. Sp. Pl. 85. 1753; Thurb. in Wats. Bot. Cal. 2: 325. 1880; Davy in Jepson, Fl. W. Mid. Cal. 83. 1901; Abrams, Fl. Los Ang. 60. 1904.

69. **ELYMUS** L.

Spikelets 2 to 6-flowered, in pairs, sessile at the joints of a continuous rachis, rarely single or more than two together. Glumes equal, usually narrow and rigid, 1 to 3-nerved, acute or awned, placed at the sides or close together in front of the florets. Lemmas convex, obscurely 5-nerved, usually acute or awned from the apex. Erect perennials (except E. caput-medusae) with terminal often bristly spikes.—Species about 25, in temperate regions of both hemispheres. (Greek elumos, an ancient name for a kind of millet.)

Plants annual ..... 1. *E. caput-medusae.*
Plants perennial.
  Glumes subulate, nearly or quite nerveless.
    Lemmas pubescent; plant cinereus-pubescent ..... 2. *E. cinereus.*
    Lemmas glabrous or hispidulous.
      Plant stout and tall; blades usually more than 4 lines wide, flat; rhizomes thick; spike dense ..... 3. *E. condensatus.*
      Plant slender; blades usually less than 2½ lines wide, involute; rhizome slender; spike slender ..... 4. *E. triticoides.*
  Glumes lanceolate, distinctly nerved.
    Plant producing rhizomes ..... 5. *E. arenarius.*
    Plant not producing rhizomes.
      Awn of lemma a short point ..... 6. *E. pubescens.*
      Awn of lemma once or twice as long as body ..... 7. *E. glaucus.*

1. **E. caput-medusae** L. Annual; culms branched at base, erect or decumbent at base, slender, 8 inches to 2 feet high; blades narrow and short; spike 1 to 2 inches long, long-awned; glumes awl-shaped, smooth, indurated below, narrowed into a slender awn ½ to 1 inch long; lemmas lanceolate, 3-nerved, 3 lines long, flat, very scabrous, gradually narrowed into a flat awn, 2 to 4 inches long.

Open ground, California to Washington; introduced from Europe. Klamathon, *Copeland* 3493; Los Gatos, *Hitchcock* 2631.

Ref.—ELYMUS CAPUT-MEDUSAE L. Sp. Pl. 84. 1753.

2. **E. cinereus** Scribn. & Merr. Culms erect, stout, puberulent, 4 to 5 feet high; sheaths and blades cinereus-pubescent, the latter with an indurated point; spike erect, 6 to 8 inches long, dense, interrupted below; spikelets 7 to 9 lines long; glumes subulate, about ½ inch long, scabrous-pubescent; lemmas scabrous-pubescent, especially the apex, faintly nerved, obtuse, mucronate or with a short awn-point.

The type is from Pahrump Valley, Nevada. The only specimen seen from California is from Lancaster, *Elmer* 3662.

Ref.—ELYMUS CINEREUS Scribn. & Merr. Bull. Torr. Club 29: 467. 1902.

3. **E. condensatus** Presl. Culms in large tufts, stout, 3 to 6 feet high, producing stout knotty rhizomes; sheaths smooth; blades flat, as much as 10 lines wide; spike erect, usually dense, as much as a foot long, sometimes branched; glumes narrowly lanceolate or subulate, awn-pointed, usually only 1-nerved, or nerveless; about as long as the first lemma; lemmas awnless or mucronate.

Dry plains and hillsides and along gullies and ditches, southern California to British Columbia and Alberta, and east to Nebraska. In California found especially in the coastal region from San Francisco southward. A botanic garden specimen from Davy, said to have been cultivated at Berkeley from seed from San Emigdio Cañon, Kern Co., and a second cultivated specimen of which the source

is not given, have very compound panicles, about 13 inches long and 3 inches wide.

Var. **pubens** Piper. Sheaths and blades pubescent.—Santa Barbara, *Hitchcock* 2582; also in Washington.

Refs.—Elymus condensatus Presl, Rel. Haenk. 1: 265. 1830, type from Monterey, *Haenke;* Thurb. in Wats. Bot. Cal. 2: 326. 1880; Davy in Jepson, Fl. W. Mid. Cal. 78. 1901; Abrams, Fl. Los Ang. 61. 1904. Var. pubens Piper, Erythea 7: 101. 1901.

4. **E. triticoides** Buckl. Culms usually glaucous, 2 to 4 feet tall, usually in large masses, from extensively creeping, scaly rhizomes; sheaths smooth or scabrous; blades narrow, mostly 1 to 3 lines wide, flat or soon involute; spike erect, slender, sometimes branched; glumes subulate, 5 to 7 lines long; lemmas 3 to 5 lines long, glabrous, short-pointed.

Moist bottomland and alkaline soil, throughout the state, commoner in the southern portion; north to Washington and east to Colorado and Arizona.

Var **pubescens** Hitchc. n. var. Sheaths and involute blades hirsute-pubescent. —(Et laminae involutae et vaginae hirsutae.)—Type in the National Herbarium, collected at Griffin, Ventura Co., by Elmer (no. 3748). No other specimens have been observed.

Refs.—Elymus triticoides Buckl. Proc. Acad. Phila. 1862: 99. 1863; Davy in Jepson, Fl. W. Mid. Cal. 78. 1901; Abrams, Fl. Los Ang. 61. 1904. *E. condensatus* Presl var. *triticoides* Thurb. in Wats. Bot. Cal. 2: 326. 1880. *E. orcuttianus* Vasey, Bot. Gaz. 10: 258. 1885, type from San Diego, *Orcutt;* Abrams, Fl. Los Ang. 62. 1904. *Agropyron arenicolum* Davy in Jepson, Fl. W. Mid. Cal. 76. 1901, type from Pt. Reyes, *Davy* 6879; the following dwarfed seacoast specimens, 6 to 10 inches high, also belong to this: Pt. Reyes, *Davy* 6781; mouth of Salinas River, *Davy* 7548; Pacific Grove, *Hitchcock* 2608; Monterey, *Davy* 7272; Pt. Sur, *Davy* 7752.

5. **E. arenarius** L. Culms stout, smooth, or pubescent above, glaucous, 2 to 4 feet high from creeping rhizomes; sheaths and blades smooth or the latter scabrous above; spike erect, dense, 3 to 10 inches long; glumes lanceolate, flat, many-nerved, scabrous or pubescent, 5 to 10 lines long, acuminate, awnless, about as long as the spikelet; lemmas about as long as glumes, scabrous or felty-pubescent, acuminate or mucronate.

Sand dunes along the coast: Santa Cruz, *Anderson;* San Mateo Co., *Elmer* 4770; Westport, *Congdon.* Northern coasts of North America and Eurasia.

Refs.—Elymus arenarius L. Sp. Pl. 83. 1753; Thurb. in Wats. Bot. Cal. 2: 326. 1880; Davy in Jepson, Fl. W. Mid. Cal. 77. 1901.

6. **E. pubescens** Davy. Culms 1 to 3 feet high; scabrous, sheaths scabrous and pubescent; blades flat or loosely involute, short; spike 2 to 4 inches long; glumes linear-lanceolate, flat, acuminate, unawned, about 6 lines long, scabrous, about 5-nerved; lemmas scarcely as long as the glumes, short-awned.

Pt. Arena, *Davy* 6028 (the only specimen in the National Herbarium), to Pt. Reyes.

Ref.—Elymus pubescens Davy in Jepson, Fl. W. Mid. Cal. 78. 1901, type from Pt. Reyes, *Davy.*

7. **E. glaucus** Buckl. Culms erect, 2 to 4 feet high, without rhizomes; sheaths smooth or scabrous; blades flat, as much as 5 lines wide, scabrous on both surfaces, sometimes narrow and more or less involute; spike erect, usually dense, long-exserted, 2 to 6 inches long, rarely longer; glumes about as long as the spikelet, lanceolate, 4 to 6 lines long, acuminate or awn-pointed, with 2 to 4 scabrous nerves; lemmas awned, the awn 1 to 2 times as long as the body.

Open woods, copses, and dry hillsides, throughout the state, north to Alaska and east to Michigan and Missouri.

Var. **jepsoni** Davy. Distinguished by the more or less pubescent sheaths and blades.—Dry woods and ravines, known only from California.

Locs.—Ft. Bragg, *Davy & Blasdale* 6136; Albion, *Davy & Blasdale* 6065; Cloverdale, *Hitchcock* 2684; San Rafael, *Bolander* 2284; Mt. Tamalpais, *Piper* 6312; Yosemite Nat. Park, *Hitchcock* 3353; Northfork, *Griffiths* 6650; Acton, *Elmer* 3750; San Bernardino Mts., *Abrams* 2762; San Jacinto Mts., *Parish Bros.* 1014.

Refs.—ELYMUS GLAUCUS Buckl. Proc. Acad. Phila. 1862: 99. 1863; Davy in Jepson, Fl. W. Mid. Cal. 78. 1901; Abrams, Fl. Los Ang. 62. 1904. *E. sibiricus* [L. misapplied by] Thurb. in Wats. Bot. Cal. 2: 326. 1880. *E. angustifolius* Davy in Jepson, Fl. W. Mid. Cal. 80. 1901, type from San Francisco, *Davy*. Var. *caespitosus* Davy in Jepson, Fl. W. Mid. Cal. 81. 1901, type from Berkeley Hills, *Davy*. *E. glaucus* Buckl. var. *breviaristatus* Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Pt. Reyes, *Davy*. Var. *maximus* Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Napa Valley, *Jepson*. Var. *tenuis* Vasey, Contr. Nat. Herb. 1: 280. 1893. Var. JEPSONI Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Napa Valley, *Jepson*. *E. hispidulus* Davy in Jepson, Fl. W. Mid. Cal. 79. 1901, type from Olema, *Davy* 4306b. *E. divergens* Davy in Jepson, Fl. W. Mid. Cal. 80. 1901, type from Petaluma, *Davy* 4037. *E. velutinus* Scribn. & Merr. Bull. Torr. Club 29. 466. 1902, type from Deep Creek, San Bernardino Mts., *Abrams* 2056. *E. parishii* Davy & Merr. Univ. Cal. Publ. Bot. 1: 58. 1902, type from Mt. San Jacinto, *Hall* 2097.

Elymus glaucus is variable in habit and some of its forms, as seen from the above synonymy, have received varietal names and others have been considered distinct species. Var. *breviaristatus* Davy has short-awned spikelets; var. *tenuis* Vasey is a slender form; var. *maximus* Davy is a large form with blades as much as 8½ lines wide. *Elymus angustifolius* Davy and *E. angustifolius* var. *caespitosus* Davy appear to be narrow-leaved forms of E. glaucus. I have been unable satisfactorily to separate any of these as distinct species.

70. **SITANION** Raf.

Spikelets 2 to several-flowered, in 2's or 3's, rarely solitary, at each joint of the articulate rachis. Glumes entire, bifid or several-parted, narrow or setaceous, long-awned. Lemmas long-awned. Tufted perennials with bristly, readily disarticulating spikes.—Species about 12, western North America. (Greek sitos, grain for food.)

Glumes cleft or parted into 3 to many lobes.
  Awn of lemma 1½ to 4 inches long....2. *S. jubatum.*
  Awn of lemma 7 to 10 lines long....3. *S. breviaristatum.*
Glumes entire or 2-cleft or 2-parted.
  Glumes, or some of them, 3-nerved....1. *S. hanseni.*
  Glumes 2-nerved.
    Glumes entire....6. *S. californicum.*
    Glumes, or some of them, bifid.
      Plants alpine, mostly less than 8 inches high; awns usually about 1 inch long....4. *S. minus.*
      Plants of medium altitudes, mostly more than 8 inches tall; awns usually 1½ to 2 inches long....5. *S. glabrum.*

1. **S. hanseni** J. G. Smith. Culms rather slender, loosely tufted; sheaths smooth or scabrous; blades flat or involute; spike rather slender, 2 to 3 inches long; glumes narrowly lanceolate, some of them 1-nerved and entire, others broader and 3-nerved, often bifid; lemmas smooth, scabrous toward apex, 4 lines long; awns erect, about an inch long.

A rare species only known from California. The habitat is not given on any of the specimens cited below.

Locs.—Agricultural Station, Amador Co., *Hansen* 1742; Santa Lucia Mts., *Davy* 7717; Tassajara Hot Springs, *Elmer* 3307; Templeton, *Davy* 7583, 7586, 7592, 7593, 7594; Temescal Mts., *Abrams* 1814.

Refs.—SITANION HANSENI J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 20. 1899, based on *Elymus hanseni*. *Elymus hanseni* Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 11: 56. 1898, type *Hansen* 1742. *Sitanion anomalum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 20. 1899, type from Pasadena, *Allen;* Abrams, Fl. Los Ang. 64. 1904.

2. **S. jubatum** J. G. Smith. Culms erect, 1 to 2 feet high, rarely taller; sheaths smooth, scabrous or villous-pubescent; blades flat, often becoming involute, smooth or usually more or less pubescent, at least on upper surface, usually not over 1½ lines wide; spike erect, dense, 1 to 3 inches long, thick and bushy from the numerous long awns; glumes split into 3 or more lobes or divisions, each extending into a long awn; lemmas mostly 4 to 5 lines long, smooth, or scabrous toward apex, the awns and those of the glumes 1½ to 4 inches long.

Rocky or brushy hillsides and open dry woods and plains, California to Washington.

As here understood the species includes the following.—The original *S. jubatum* of Washington, with tall stout culms and large spikes with awns about 4 inches long (Ojai Valley, Ventura Co. *Hubby* 48); *S. villosum*, with villous-pubescent leaves, and awns 2 to 3 inches long (Modoc Co., *Davy;* Sonoma Co., *Samuels* 225; Solano Co., *Heller* 5580; Alameda Co., *Brewer* 1220; Santa Clara Co., *Elmer* 5047; Stanislaus Co., *Elmer* 4852; Northfork, *Griffiths* 4634; Santa Lucia Mts., *Davy* 7681; Templeton, *Davy* 7691; Tehachapi, *Chase* 5742; Ramona, *Brandegee* 88); *S. multisetum*, similar to *S. jubatum* but culms lower and awns shorter, common in the Coast Ranges from the San Francisco Bay region southward, intergrading with the typical form and also with *S. villosum:* and *S. polyanthrix*, more or less pubescent, and having awns 1½ to 2 inches long, a few scattered specimens resembling the type of *S. polyanthrix* (Yreka, *Butler* 823; Modoc Co., *Griffiths & Hunter* 482; Dixie Mts., *Davy;* Vacaville, *Jepson* 4247; Los Gatos, *Heller* 7498, *Hitchcock* 2640; Mariposa Co., *Congdon;* Cuyamaca Mts., *Brandegee* 111). The California specimens so intergrade that it has been impossible to separate satisfactorily these forms.

Refs.—Sitanion jubatum J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 10. 1899; Abrams, Fl. Los Ang. 63. 1904. *S. villosum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 11. 1899. *S. multisetum* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 11. 1899, type *Coville & Funston* 1121; Abrams, Fl. Los Ang. 63. 1904. *S. polyanthrix* J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 12. 1899, based on *Polyanthrix hystrix*. *Polyanthrix hystrix* Nees, Ann. Nat. Hist. 1: 284. 1838, type from California, *Douglas*. All the California species are included under *Elymus sitanion* Schult. by Thurber (Wats. Bot. Cal. 2: 327. 1880) and Davy (Jepson, Fl. W. Mid. Cal. 81. 1901).

3. **S. breviaristatum** J. G. Smith. Culms 1 to 1½ feet high; sheaths glabrous, slightly scabrous, the lower papery; blades long, involute; spike 1 to 2 inches long; glumes split as in S. jubatum, the awns of glumes and lemmas 7 to 10 lines long, spreading or recurved.

A little-known species (or possibly a form of S. jubatum) represented by only two specimens: Madison, *Heller* 5577; Panamint Mts., *Coville & Funston* 833.

Ref.—Sitanion breviaristatum J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 12. 1899, type *Coville & Funston* 833.

4. **S. minus** J. G. Smith. Culms low, much tufted, mostly 4 to 8 inches high; sheaths smooth or somewhat scabrous, or puberulent, the old ones usually numerous at the base of the culms; blades smooth or puberulent; spike 1 to 2 inches long; glumes, or at least some of them, bifid from near the base; lemmas smooth; awns about an inch long, spreading.

Dry hills and rocky slopes, California to Washington, mostly at altitudes above 5000 feet.

Loes.—Yreka, *Butler* 1278 (differs in being pilose, thus referable to *S. ciliatum* Elmer of Washington, if that prove to be a distinct species); Mt. Shasta, *Brown* 372; Last Chance, *Dotey* 46; Ebbetts Pass, *Brewer* 2072; Mt. Lyell, *Hitchcock* 3305; Mt. Pinos, *Hall* 6551; Griffin, *Elmer* 3990; Mt. San Antonio, *Abrams* 1932, 2700; San Gorgonio Peak, *Hall* 7633; San Jacinto Peak, *Reed* 2497; Tahquitz Peak, *Reed* 2530.

Refs.—Sitanion minus J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 12. 1899, type from Jacumba, San Diego Co., *Schoenfeldt* 3277. *S. rigidum* J. G. Smith, op. cit. 13.

5. **S. glabrum** J. G. Smith. Culms 6 to 15 inches high; sheaths smooth or somewhat scabrous; blades soon involute, glabrous or scabrous below, puberulent above; spike 1 to 2 inches long, dense; glumes, or some of them, bifid to near the base; lemmas smooth, the awns slender, 1 to 2 inches long.

Dry, mostly alkaline soil, Mt. Pinos north to Washington, east to Wyoming.

Locs.—Grenada, *Heller* 8071; Southern Belle Mine, Mono Co., *Heller* 8329; Hunter's Ranch Mts., Inyo Co., *Hall & Chandler* 7146; Argus Mts., *Purpus* 5381; San Francisco, *Brewer* 1553; Antelope Valley, *Davy* 2313; Cuyama White Hills, *Eastwood;* Mt. Pinos, *Hall* 6636.

Ref.—Sitanion glabrum J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 14. 1899, type from Coso Mts., *Coville & Funston* 914.

6. **S. californicum** J. G. Smith. Culms 1 to 2 feet high; sheaths glabrous or scabrous, sometimes puberulent; blades flat or becoming involute, glabrous beneath, scabrous above, sometimes puberulent; spike 2 to 3 inches long, rather loose and open; glumes entire, long-awned; lemmas smooth, 4 to 5 lines long; awns 1½ to 2½ inches long.

Gravelly or rocky slopes and dry open woods, mostly at rather high altitudes, from the southern boundary, northward through the San Jacinto and San Bernardino mountains and the Sierra Nevada to Washington; also in the region of Mt. Shasta.

Refs.—Sitanion californicum J. G. Smith, U. S. Dept. Agr. Div. Agrost. Bull. 18: 13. 1899, type from San Bernardino Mts., *Parish* 3295; Abrams, Fl. Los Ang. 64. 1904.

71. **HYSTRIX** Moench.

Spikelets 2 to 4-flowered, nearly sessile, 1 to 3 together at each joint of the continuous rachis, and facing it as in Elymus, widely divergent at maturity. Glumes reduced to short or minute awns, the first usually obsolete, both often wanting in the upper spikelets. Lemmas convex, rigid, tapering into long awns. Perennials, with flat blades and loosely-flowered bristly spikes.—Species 4, temperate regions, 2 in North America, 1 in Siberia, 1 in New Zealand. (Greek hustrix, a porcupine.)

1. **H californica** Kuntze. Culms stout, 3½ to 6 feet high; sheaths hispid or the upper smooth; blades flat, as much as ¾ inch wide, scabrous; spike stout, dense and somewhat nodding above, more or less interrupted below, 5 to 10 inches long; spikelets mostly in pairs, 1 to 3-flowered, on short callus-like pedicels; glumes wanting; lemmas 6 to 7 lines long, 5-nerved above, the nerves, especially the marginal, ciliate-hispid with short stiff hairs; awn stout, straight, rough, about 10 lines long.

Woods and shaded banks, near the coast, Marin to Santa Cruz cos.

Locs.—Olema, *Davy* 4306, 4318; near San Francisco, *Kellogg & Harford* 1107; San Gregorio redwoods, *Kellogg & Brannan;* Crystal Lake Springs, *Elmer* 4700; Santa Cruz, *Anderson.*

Refs.—Hystrix californica Kuntze, Rev. Gen. Pl. 778. 1891. *Gymnostichum californicum* Boland.; Thurb. in Wats. Bot. Cal. 2: 327. 1880, type from San Francisco, *Bolander. Asperella californica* Beal, Grasses N. Am. 2: 657. 1896; Davy in Jepson, Fl. W. Mid. Cal. 81. 1901.

CYPERACEAE. Sedge Family.

Grass-like or rush-like herbs with fibrous roots, many species perennial by long rootstocks. Stems solid (rarely hollow), usually triangular or terete, commonly scape-like with mostly basal leaves. Leaves alternate, narrow, with closed sheaths, often 3-ranked. Flowers one in the axil of each bract (scale),

borne in spikelets or spikes which are arranged in clusters, racemes, panicles or umbels. Perianth none or represented by usually 4 to 6 bristles. Stamens 1 to 3. Pistil 1; ovary 1-celled with 1 ovule, the single style 2 or 3-cleft. Fruit a lenticular or 3-angled achene. Embryo minute in mealy endosperm.—About 65 genera and 3000 species, widely distributed over the earth, chiefly as marsh plants.

Bibliog.—Clarke, C. B., Indian Species of Cyperus (Jour. Linn. Soc. vol. 21, pp. 1-202,—1884). Britton, N. L., Preliminary List N. Am. Species of Cyperus (Bull. Torr. Club, vol. 13, pp. 205-16,—1886); Genus Eleocharis in N. Am. (Jour. N. Y. Mic. Soc. vol. 5, pp. 95-111,—1889); List of Species of Scirpus and Rhynecospora in N. Am. (Trans. N. Y. Acad. Sci. vol. 11, pp. 74-93,—1892). Bailey, L. H., Preliminary Synopsis N. Am. Carices (Proc. Am. Acad. vol. 22, pp. 59-157,—1886). Parish, S. B., Preliminary Synopsis of Southern California Cyperaceae (a series of papers in Bull. S. Cal. Acad. Sci. vols. 3-5, 1904-1906). Clarke, C. B., New Genera and Species of Cyperaceae (Kew. Bull. Add. Ser. 8,—1908). Kükenthal, Georg, Caricoideae (Engler, Pflzr. teil 4, abt. 20,—1909).

Flowers all perfect; spikelets many-flowered, with 1 or 2 of the lower scales empty.—Scirpeae.
  Spikelets flattened, the scales in 2 opposite ranks; inflorescence involucrate.....1. Cyperus.
  Spikelets cylindrical, the scales imbricated around the axis in several rows.
    Style enlarged or bulbous at base.
      Bulbous base of style persistent on the achene; perianth bristles generally present; spikelet solitary, terminating the naked stem, the leaves at base reduced to sheaths..2. Eleocharis.
      Bulbous base of style deciduous, not persistent on achene; perianth bristles none; spikelets umbellate or capitate, the stems leafy at base.....3. Fimbristylis.
    Style not enlarged at base; perianth bristles usually present.
      Scales not enclosing a bractlet; perennials.
        Perianth bristles (1 to 8) barbed or none; stamens mostly 3; spikelets solitary or clustered or in a compound umbel; stem often leafy at base and inflorescence involucrate .....4. Scirpus.
        Perianth bristles numerous, naked, long-exserted and silky in fruit; stamens 1 to 3; spikelets few, otherwise as in Scirpus.....5. Eriophorum.
      Scales enclosing a minute bractlet; annuals.....6. Hemicarpha.
Flowers of 2 kinds, perfect and staminate; spikelets few (1 or 2, sometimes to 6)-flowered, with 3 to several of the lower scales empty.—Rhyncospereae.
  Scales 2-ranked; style wholly deciduous.....7. Schoenus.
  Scales spirally imbricated.
    Style wholly deciduous; perianth bristles none.....8. Cladium.
    Style or its base persistent as a tuberele or beak on the achene; perianth bristles commonly present .....9. Rhyncospora.
Flowers monoecious or sometimes dioecious; spikes unisexual or androgynous; achene enclosed in a sac (perigynium) or spathe.—Careceae.....10. Carex.

1. CYPERUS L. Galingale.

Annuals or perennials. Stems triangular or terete, never branched, leafy at base. Inflorescence subtended by a conspicuous leafy involucre, umbellate with unequal rays and a sessile central spike, or capitate. Flowers in flattened or subterete spikelets, the spikelets in capitate clusters or arranged in spikes borne on the rays. Scales concave, more or less carinate, 2-ranked. Perianth none.—Species 544, all continents but chiefly in the warmer parts of the earth. (Greek Kupeiros, the ancient name.)

Style 2-cleft; achene lenticular or at least not triangular; spikelets flat; scales falling from the rachis; rachis not winged.
  Spikelets in a close terminal cluster; scales sharply carinate; achene lenticular.
    Achene oblong; stamens 2; scales obtuse, 1 line long.....1. *C. melanostachyus.*
    Achene ovoid; stamens 3; scales acute, 2 lines long.....2. *C. bromoides.*
  Spikelets in an apparently lateral cluster; stamens 3; scales scarcely carinate; achene plano-convex .....3. *C. laevigatus.*

Style 3-cleft; achene 3-angled.
Spikelets flattened; scales falling away from the rachis which is persistent on the spike.
Rachis naked or nearly so, the scales not decurrent upon it; stamen 1.
Scales not toothed on back; low or dwarf annuals.
Scales 7 to 9-nerved, with strongly recurved setaceous tips.....4. *C. aristatus.*
Scales obscurely 3-nerved, with short recurved tips.....5. *C. acuminatus.*
Scales minutely toothed on back at apex, obtuse or merely acute, without recurved tips; tall perennial.....6. *C. virens.*
Rachis with the scales decurrent upon it as narrow scarious wings; stamens 3.
Wings of the rachis soon separating to the base; annual.
Wings persistent on the rachis.....7. *C. erythrorhizos.*
Wings readily deciduous.....8. *C. sphacelatus.*
Wings of the rachis persistent; perennial by means of tuber-bearing rootstocks.....9. *C. esculentus.*
Spikelets not so strongly flattened, deciduous from (but the 2 lowest scales persistent on) the spike; wings broad, scarious, wholly adnate to rachis; stamens 3.
Perennials with basal tuber-like corms; spikelets falling whole; wings not enclosing achenes.....10. *C. strigosus.*
Annuals; spikelets breaking up into 1-fruited joints; wings very broad, enclosing achenes.
Spikes oblong, compact.....11. *C. speciosus.*
Spikes short, loose and spreading.....12. *C. ferax.*

1. **C. melanostachyus** H. B. K. Annual; stems very slender, triangular, ¾ to 1 foot high; leaves elongate-tapering, 1 line wide or less; involucral bracts 2 or 3, foliaceous, narrowly linear, ½ to 3½ inches long; spikelets oblong, 3 to 6 lines long, in a small capitate cluster; scales chestnut-brown, keeled, 3-nerved on back, very obtuse, 1 line long; achene lenticular, sharply beaked. Jackson, *Hansen* 644; lower Sacramento River, *Jepson;* San Francisco, *Bolander* 2330; Los Angeles River, *Braunton* 566; San Bernardino, *Parish* 3811. Mexico south to Argentina.

Refs.—Cyperus melanostachyus H. B. K. Nov. Gen. & Sp. 1:207 (1815). *C. diandrus* Torr. var. *castaneus* Torr.; Wats. Bot. Cal. 2:214 (1880); var. *capitatus* Britton, Bull. Torr. Club, 13:205 (1886). *Pycreus melanostachyus* C. B. Clarke, Contrib. U. S. Nat. Herb. 10:446 (1908).

2. **C. bromoides** Link. Annual; stems slender, 1 to 1⅔ feet high, exceeding the few rough-margined leaves; spikelets 4 to 9 lines long; involucral leaves 2 to 4, the longest 4 to 5½ inches long; scales acute, yellow-brown, about 2 lines long, the keel 3-nerved and the margins scarious; achene ovoid, black, ⅓ as long as scale.

Los Angeles Co. acc. Parish; Mexico and tropical regions of the Americas.

Refs.—Cyperus bromoides Link, Jahrb. Berl. 1[8]: 85 (1818); Parish, Bull. S. Cal. Acad. Sci. 3:49 (1904). *C. uniloides* R. Br. var. *bromoides* Clarke, Jour. Linn. Soc. 21:60 (1884).

3. **C. laevigatus** L. Perennial, the stems arising at intervals from a wiry rootstock; stems subterete, slender, 3 to 10 inches high, hardly surpassing the erect filiform leaves; spikelets 2 to 5, 2 to 4 lines long, in a sessile apparently lateral cluster; involucre of usually 2 bracts, one long (1 to 2 inches) and erect, in continuation of stem, the other short (3 or 4 lines long) or wanting; rachis deeply pitted transversely; scales orbicular, 3-nerved in middle, a brown blotch on each side, closely imbricated, ¾ line long; achene oblong, gray, ½ as long as scale.

Along streams in wet sand: Big Morongo, Colorado Desert, acc. *Parish;* San Bernardino, *Parish;* Pasadena, *McClatchie;* Los Angeles, *Brewer.* South into Mexico. All continents.

Refs.—Cyperus laevigatus L. Mant. 2:179 (1771); Wats. Bot. Cal. 2:214 (1880).

4. **C. aristatus** Rottb. Dwarf annual; stems ½ to 6 inches high, barely exceeding the leaves; leaves flat, ½ line or less wide; involucral bracts folia-

ceous, ½ to 2 inches long; spikelets linear-oblong, 1½ to 3 lines long, in a dense compound head or in close clusters on 2 or 3 short (¼ to 1 inch long) rays; rachis not winged; scales 7 to 9-nerved, with strongly recurved setaceous tips, chestnut-brown or greenish, ⅔ to 1 line long; achene 3-angled.

San Jacinto Mts., *Hall* 2663; San Bernardino Valley, *Parish;* Mohave River, *ace. Parish;* Tehipite Valley, 4000 feet alt., *Hall & Chandler* 510; Yosemite, *Bolander* 6223; Hetch-Hetchy, *Jepson* 3479; Jackson, *Hansen* 643; Chico, *Greene, Copeland* 3489; north to British Columbia and east to the Atlantic States. South America, Africa, Asia, Australia.

Refs.—CYPERUS ARISTATUS Rottb. Desc. Nov. Pl. 22 (1773). *C. inflexus* Muhl. Gram. 16 (1817).

5. **C. acuminatus** Torr. & Hook. Annual; stems slender, tufted, 5 to 12 inches high; leaves commonly less than 1 line wide; bracts of the involucre 2 or 3, much elongated; spikelets 3 or 4 lines long, capitate on the rays or the whole inflorescence congested and head-like; scales oblong, obscurely 3-nerved, with a short recurved tip; achene 3-angled, about ½ as long as scale.

Round Meadow, Giant Forest, *Grant* 2436; Tulare Co., *Congdon*, ace. Britton; Oregon, Washington; Arizona east to Louisiana and Illinois.

Refs.—CYPERUS ACUMINATUS Torr. & Hook. Ann. Lyc. N. Y. 3:435 (1836); Britton, Bull. Torr. Club, 13:209 (1886).

6. **C. virens** Michx. Perennial; stems triangular, 1 to 3 feet high; involucral bracts 4 to 6, very long and leafy, broad and strongly keeled; umbel compound, or the spikes capitate on the rays, or the whole often much reduced and subcapitate; spikelets numerous, many-flowered, long-oblong, 4 to 8 lines long; scales concave-carinate, serrulate on back at apex, 1 line long; achene 3-angled.

Mt. Shasta, *Grant;* Chico, *Copeland* 3490; Ione, *Braunton* 1012; Grand Island, *Jepson;* Healdsburg, *King;* Berkeley, *Walker* 434; San Francisco, *Bioletti;* Los Gatos, *Heller* 7487; Kings River, *Lemmon;* San Bernardino, ace. *Parish*. East to North Carolina and south to Central America.

Refs.—CYPERUS VIRENS Michx. Fl. Bor. Am. 1:28 (1803); Wats. Bot. Cal. 2:214 (1880). *C. serrulatus* Wats. Proc. Am. Acad. 17:382 (1882), type loc. Placer County, *George Vasey;* Jepson, Fl. W. Mid. Cal. 84 (1901).

7. **C. erythrorhizos** Muhl. Annual; stems 1 to 1½ feet high, stout, triangular; leaves flat or conduplicate, 6 to 14 inches long, 2 to 3 lines wide; involucral bracts 6 to 8, foliaceous, 4 to 12 inches long; rays 1½ inches long or less, bearing umbels of spikes which are ½ to 1 inch long; bracts of involucels shorter, foliaceous; spikelets usually 2 to 3 lines long, narrowly linear, somewhat crowded, horizontally spreading, nearly flat, bright chestnut-color; rachis clothed with the persistent wings of the scales; scales elliptical, obtuse, mucronulate, ⅔ line long; keel smooth; achene 3-angled.

Clear Lake, *Bolander* 2631; Sacramento and San Joaquin valleys along the main rivers. East to the Atlantic States.

Refs.—CYPERUS ERYTHRORHIZOS Muhl. Gram. 20 (1817); Wats. Bot. Cal. 2:215 (1880); Jepson, Fl. W. Mid. Cal. 85 (1901).

8. **C. sphacelatus** Rottb. Annual, similar in habit to the next; stems tufted, slender, 4 to 10 inches high; leaves 1 to 2½ lines wide, shorter than the stems; spikelets numerous, densely short-spicate, linear, 1 line wide; rachis at length wingless, the narrow wings early deciduous; scales oblong-lanceolate, purple-green, several nerved, 1 line long; achenes nearly black, 3-angled, ½ as long as scale.

JEPSON, Fl. Cal. vol. 1, pp. 190-192, April 30, 1912.